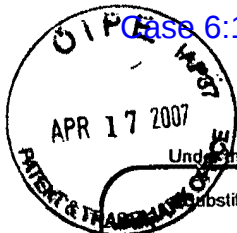


EXHIBIT 11



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Complete if Known

Application Number	09/657,181
Filing Date	September 7, 2000
First Named Inventor	Scott A. MOSKOWITZ et al.
Art Unit	2857
Examiner Name	NA
Attorney Docket Number	80408.0012

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
		US-4,939,515	07/03/1990	Adelson	
		US-5,161,210	11/03/1992	Druyvesteyn, et.al.	
		US-5,450,490	09/12/1995	Jensen et.al.	
		US-5,530,751	06/25/1996	Morris	
		US-5,579,124	11/26/1996	Aijala et.al.	
		US-5,721,788	02/24/1998	Powell et.al.	
		US-5,828,325	10/27/1998	Wolose Wicz et.al.	
		US-5,912,972	06/15/1999	Barton	
		US-5,930,377	07/27/1999	Powell et.al.	
		US-5,583,488	12/10/1996	Sala et.al.	
		US-5,748,783	05/05/1998	Rhoads	
		US-6,330,672	12/11/2001	Shur	
		US-5,243,423	09/07/1993	DeJean et.al.	
		US-5,319,735	06/07/1994	Preuss et.al.	
		US-5,113,437	05/12/1992	Best et.al.	
		US-4,876,617	10/24/1989	Best et.al.	
		US-5,379,345	01/03/1995	Greenberg	
		US-5,646,997	07/08/1997	Barton	
		US-4,672,605	06/09/1987	Hustig et.al.	

FOREIGN PATENT DOCUMENTS

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		Country Code ³ Number ⁴ Kind Code ⁵ (if known)				
		European Patent No. EP0565947A1	10/20/1993	Kuusama, Juha		
		WO 95/14289	05/26/1995	Rhoads, Geoffrey		
		European Patent No. 0581317A2	02/02/1994	Powell, Robert et.al.		
		European Patent No. 0372601A1	06/13/1990	Druyvesteyn, Wm. et.al.		
		W098/37513	08/27/1998	Biggar, Michael et.al.		
		European Patent No. 0651554A	05/03/1995	Eastman Kodak Co.		

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First Named Inventor	Scott A. MOSKOWITZ et al.
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Attorney Docket Number	80408.0012

Sheet 2 of 12**U. S. PATENT DOCUMENTS**

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		Number-Kind Code ² (if known)			
		US-4,748,668	05/31/1998	Shamir, et.al.	
		US-4,789,928	12/06/1988	Fujisaki	
		US-4,908,873	03/13/1990	Philibert, et.al.	
		US-4,980,782	12/25/1990	Ginkel	
		US-5,073,925	12/17/1991	Nagata, et.al.	
		US-5,243,515	09/07/1993	Lee	
		US-5,287,407	02/15/1994	Holmes	
		US-5,428,606	06/27/1995	Moskowitz	
		US-5,365,586	11/15/1994	Indeck, et.al.	
		US-5,394,324	02/28/1995	Clearwater	
		US-5,408,505	04/18/1995	Indeck, et.al.	
		US-5,412,718	05/02/1995	Narasimhalv, et.al.	
		US-5,487,168	01/23/1996	Geiner, et.al.	
		US-5,493,677	02/20/1996	Balogh, et.al.	
		US-5,530,759	06/25/1996	Braudaway, et.al.	
		US-5,606,609	02/25/1997	Houser, et.al.	
		US-5,613,004	03/18/1997	Cooperman, et.al.	
		US-5,617,119	04/01/1997	Briggs, et.al.	
		US-			

FOREIGN PATENT DOCUMENTS

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		Country Code ³ Number ⁴ Kind Code ⁵ (if known)				
		WO 99/62044	12/02/1999	Handel, Theodore et.al		
		WIPO 96/29795	09/26/1996	Micali		
		WIPO 97/24833	07/10/1997	Micali		
		EP 0649261	04/19/1995	Enari		
		NL 100523	09/1998			

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Sheet 3 of 12**U. S. PATENT DOCUMENTS**

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		US-4,528,588	07/09/1985	Lofberg	
		US-5,832,119	11/03/1998	Rhoads	
		US-5,859,920	01/12/1999	Daly et.al	
		US-4,979,210	12/18/1990	Nagata et.al	
		US-5,774,452	06/30/1998	Wolosewicz	
		US-4,405,829	09/20/1983	Rivest et.al	
		US-6,330,335	12/11/2001	Rhoads	
		US-3,986,624	10/19/1976	Cates Jr. et.al	
		US-5,363,448	11/08/1994	Koopman et.al	
		US-5,568,570	10/22/1996	Rabbani	
		US-5,636,292	06/03/1997	Rhoads	
		US-4,972,471	11/20/1990	Gross et.al.	
		US-5,893,067	04/06/1999	Bender et.al.	
		US-5,689,587	11/18/1997	Bender et.al.	
		US-3,984,624	10/05/1976	Waggener	
		US-4,038,596	07/26/1977	Lee	
		US-4,200,770	04/29/1980	Hellman, et.al.	
		US-4,218,582	08/19/1980	Hellman, et.al.	
		US-4,424,414	01/03/1984	Hellman, et.al.	

FOREIGN PATENT DOCUMENTS

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		WO 9744736	11/27/1997	Wehrenberg		
		WO 9952271	10/14/1999	Moskowitz		
		WO 9963443	12/09/1999	Ho, Anthony Tung Shuen		

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First Named Inventor	Scott A. MOSKOWITZ et al.
Art Unit	2857
Examiner Name	NA
Attorney Docket Number	80408.0012

Sheet

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U. S. PATENT DOCUMENTS

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		US-5,640,569	06/17/1997	Miller, et.al.	
		US-5,659,726	08/19/1997	Sandford, II, et.al.	
		US-5,664,018	09/02/1997	Leighton	
		US-5,687,236	11/11/1997	Moskowitz, et.al.	
		US-5,734,752	03/31/1998	Knox	
		US-5,745,569	04/28/1998	Moskowitz, et.al.	
		US-5,506,795	04/09/1996	Yamakawa	
		US-5,680,462	10/21/1997	Miller, et.al.	
		US-5,696,828	12/09/1997	Koopman, Jr.	
		US-5,740,244	04/14/1998	Indeck, et.al.	
		US-5,751,811	05/12/1998	Koopman, Jr.	
		US-5,757,923	05/26/1998	Koopman, Jr.	
		US-5,889,868	03/30/1999	Moskowitz, et.al.	
		US-6,208,745	03/27/2001	Florenio, et.al.	
		US-6,285,775	09/04/2001	Wu, et.al.	
		US-6,385,329	05/07/2002	Sharma, et.al.	
		US-6,530,021	03/04/2003	Epstein, et.al.	
		US-6,425,081	07/23/2002	wamura	
		US-			

FOREIGN PATENT DOCUMENTS

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		US-6,522,769	02/18/2003	Rhoads, et.al.	
		US-2005/0160271	07/21/2005	Brundage, et.al	
		US-6,665,489	12/16/2003	Collart	
		US-2004/0128514	07/01/2004	Rhoads	
		US-2004/0037449	02/26/2004	Davis, et.al.	
		US-6,823,455	11/23/2004	Macy, et.al.	
		US-2003/0133702	07/17/2003	Collart	
		US-6,668,246	12/23/2003	Yeung, et.al.	
		US-6,405,203	06/11/2002	Collart	
		US-6,141,754	10/31/2000	Choy	
		US-6,493,457	12/10/2002	Quackenbush	
		US-5,629,980	05/13/1997	Stefik, et.al.	
		US-5,943,422	08/24/1999	Van Wie, et.al.	
		US-5,636,276	06/03/1997	Brugger	
		US-5,341,429	08/23/1994	Stringer, et.al.	
		US-6,754,822	06/22/2004	Zhao	
		US-6,131,162	10/10/2000	Yoshiura et.al.	
		US-7,058,570	06/06/2006	Yu, et.al.	
		US-			

FOREIGN PATENT DOCUMENTS

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First Named Inventor

Scott A. MOSKOWITZ et al.

Art Unit

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Examiner Name

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		US-5,930,369	07/27/1999	Cox, et al.	
		US-6,415,041	07/02/2002	Oami, et al.	
		US-6,141,753	10/31/2000	Zhao, et al.	
		US-2002/0097873	07/25/2002	Petrovic	
		US-6,785,815	08/31/2004	Serret-Avila, et al.	
		US-6,523,113	02/18/2003	Wehrenberg	
		US-6,233,347	05/15/2001	Chen, et al.	
		US-6,233,684	05/15/2001	Stefik, et al.	
		US-2006/0013395	01/19/2006	Brundage, et al.	
		US-7,043,050	05/09/2006	Yuval	
		US-5,809,160	09/15/1998	Powell, et al.	
		US-6,272,634	08/07/2001	Tewfik, et al.	
		US-6,282,650	08/28/2001	Davis	
		US-6,557,103	04/29/2003	Boncelet, Jr., et al.	
		US-2003/0126445	07/03/2003	Wehrenberg	
		US-6,978,370	12/20/2005	Kocher	
		US-2006/0005029	01/05/2006	Petrovic, et al.	
		US-6,278,791	08/21/2001	Honsinger, et al.	
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12

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-6,061,793	05/09/2000	Tewfik, et.al	
		US-5,809,139	09/15/1998	Grirod, et.al.	
		US-5,848,155	12/08/1998	Cox	
		US-5,915,027	06/22/1999	Cox, et.al	
		US-5,940,134	08/17/1999	Wirtz	
		US-5,991,426	11/23/1999	Cox, et.al.	
		US-6,069,914	05/30/2000	Cox	
		US-5,943,422	08/24/1999	Van Wie, et.al.	
		US-6,539,475	03/25/2003	Cox, et.al.	
		US-6,310,962	10/30/2001	chung, et.al.	
		US-6,154,571	11/28/2000	Cox, et.al.	
		US-4,969,204	11/06/1990	Jones, et.al.	
		US-6,687,683	02/03/2004	Harada, et.al.	
		US-6,373,892	04/16/2002	Ichien, et.al.	
		US-5,870,474	02/09/1999	Wasilewski, et.al.	
		US-5,418,713	05/23/1995	Allen	
		US-6,078,664	06/20/2000	Moskowitz, et.al.	
		US-6,009,176	12/28/1999	Gennaro, et.al.	
		US-6,081,587	06/27/2000	Hoffstein, et.al.	

FOREIGN PATENT DOCUMENTS

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Complete if Known

Application Number	09/657,181
Filing Date	September 7, 2000
First Named Inventor	Scott A. MOSKOWITZ et al.
Art Unit	2857
Examiner Name	NA
Attorney Docket Number	80408.0012

Sheet 8 of 12**U. S. PATENT DOCUMENTS**

Examiner Initials*	Cite No. ¹	Document Number Number-Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-6,598,162	07/22/2003	Moskowitz	
		US-6,275,988	08/14/2001	Nagashima, et al.	
		US-6,051,029	04/18/2000	Paterson, et al.	
		US-5,917,915	06/29/1999	Hirose	
		US-6,775,772	08/10/2004	Binding, et al.	
		US-6,668,246	12/23/2003	Yeung, et al.	
		US-6,351,765	02/26/2002	Pietropaolo, et al.	
		US-6,049,838	04/11/2000	Miller, et al.	
		US-5,398,285	03/14/1995	Borgelt, et al.	
		US-5,737,733	04/07/1998	Eller	
		US-2002/0103883	08/01/2002	Haverstock, et al.	
		US-5,673,316	09/30/1997	Auerbach, et al.	
		US-6,647,424	11/11/2003	Pearson, et al.	
		US-6,977,894	12/20/2005	Achilles, et al.	
		US-6,453,252	09/17/2002	Laroche	
		US-5,077,665	12/31/1991	Silverman, et al.	
		US-5,136,581	08/04/1992	Muehrcke	
		US-5,341,477	08/23/1994	Pitkin, et al.	
		US-5,581,703	12/03/1996	Baughner, et al.	

FOREIGN PATENT DOCUMENTS

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Sheet 9 of 12**U. S. PATENT DOCUMENTS**

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		Number-Kind Code ² (if known)			
		US-5,548,579	08/20/1996	Lebrun, et al.	
		US-5,905,975	05/18/1999	Ausubel	
		US-6,457,058	09/24/2002	Ullum et al.	
		US-6,381,618	04/30/2002	Jones et al.	
		US-2002/0026343	02/28/2002	Duenke	
		US-6,230,268	05/08/2001	Miwa et al.	
		US-6,199,058	03/06/2001	Wong et al.	
		US-5,920,900	07/06/1999	Poole et al.	
		US-5,884,033	03/16/1999	Duvall et al.	
		US-5,478,990	12/26/1995	Montanari et al.	
		US-6,430,302	08/06/2002	Rhoads	
		US-6,725,372	04/20/2004	Lewis et al.	
		US-6,606,393	08/12/2003	Xie et al.	
		US-6,584,125	06/24/2003	Katto	
		US-6,442,283	08/27/2002	Tewfik et al.	
		US-6,377,625	04/23/2002	Kim	
		US-6,282,300	08/28/2001	Bloom et al.	
		US-6,205,249	03/20/2001	Moskowitz	
		US-6,029,126	02/22/2000	Malvar	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	† ⁶
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Sheet 10 of 12**Complete if Known**

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		Number-Kind Code ² (if known)			
		US-5,754,697	05/19/1998	Fu et al.	
		US-5,479,210	12/26/1995	Cawley et al.	
		US-3,947,825	03/30/1976	Cassada	
		US-5,903,721	05/11/1999	Sixtus	
		US-5,790,677	08/04/1998	Fox et al.	
		US-5,243,515	09/07/1993	Clearwater	
		US-4,339,134	07/13/1982	Macheel	
		US-4,827,508	05/02/1989	Shear	
		US-4,896,275	01/23/1990	Jackson	
		US-4,977,594	12/11/1990	Shear	
		US-5,050,213	09/17/1991	Shear	
		US-5,369,707	11/29/1994	Follendore, III	
		US-5,406,627	04/11/1995	Thompson et al.	
		US-5,410,598	04/25/1995	Shear	
		US-5,469,536	11/21/1995	Blank	
		US-5,497,419	03/05/1996	Hill	
		US-5,513,261	04/30/1996	Maher	
		US-5,530,739	06/25/1996	Okada	
		US-5,598,470	01/28/1997	Cooper et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
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		US-5,625,690	04/29/1997	Michel et al.	
		US-5,633,932	05/27/1997	Davis et al.	
		US-5,719,937	02/17/1998	Warren et al.	
		US-5,737,416	04/07/1998	Cooper et al.	
		US-5,765,152	06/09/1998	Erickson	
		US-5,799,083	08/25/1998	Brothers et al.	
		US-5,973,731	10/26/1999	Schwab	
		US-5,894,521	04/13/1999	Conley	
		US-5,905,800	05/18/1999	Moskowitz et al.	
		US-5,963,909	10/05/1999	Warren et al.	
		US-5,974,141	10/26/1999	Saito	
		US-5,999,217	12/07/1999	Berners-Lee	
		US-6,041,316	03/21/2000	Allen	
		US-6,081,251	06/27/2000	Sakai et al.	
		US-6,278,780	08/21/2001	Shimada	
		US-6,301,663	10/09/2001	Kato et al.	
		US-6,240,121	05/29/2001	Senoh	
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

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09/657,181

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September 7, 2000

First Named Inventor

Scott A. MOSKOWITZ et al.

Art Unit

2857

Examiner Name

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Attorney Docket Number

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United States Patent [19]
Cassada

[11] **3,947,825**
[45] **Mar. 30, 1976**

[54] **ABSTRACTING SYSTEM FOR INDEX SEARCH MACHINE**

[75] Inventor: **Thomas Edward Cassada**,
Lexington, Ky.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[22] Filed: **May 7, 1975**

[21] Appl. No.: **575,318**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 350,880, April 13, 1973, which is a continuation-in-part of Ser. No. 157,565, June 28, 1971.

[52] U.S. Cl. **340/172.5**

[51] Int. Cl.² **G06F 1/00**

[58] Field of Search 340/172.5; 197/19; 271/9

[56] **References Cited**

UNITED STATES PATENTS

3,309,677	4/1967	Montgomery et al.	340/172.5
3,417,379	12/1968	Heard et al.	340/172.5
3,577,127	4/1971	Bishop et al.	340/172.5
3,598,396	8/1971	Andrews et al.	271/9
3,674,125	7/1972	Kolpek	197/19

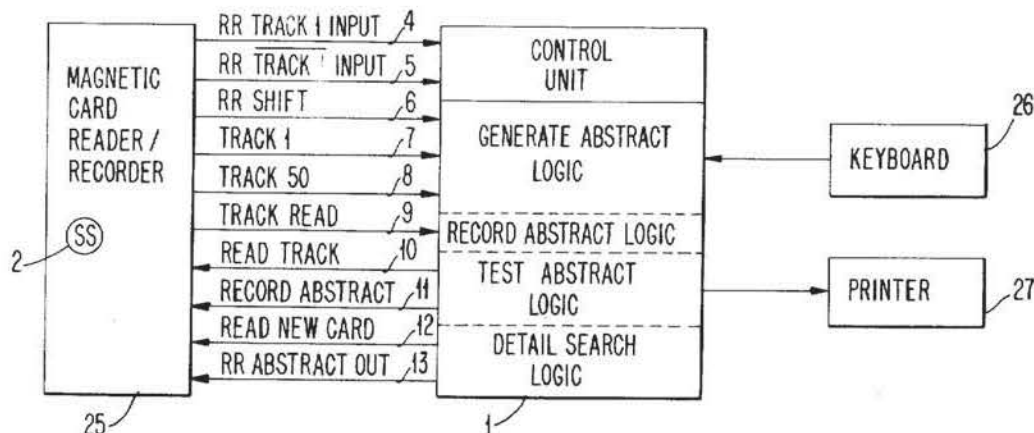
Primary Examiner—Raulfe B. Zache
Attorney, Agent, or Firm—D. Kendall Cooper

[57] **ABSTRACT**

The invention concerns a system of English language abstracting used to increase the search rate for an Index Search machine that, as an example makes use of magnetic record cards each having in a typical case 50 tracks for recording of information. To increase the rate at which groups of words can be compared, an abstract of each group of words is generated. On the magnetic card the text or groups of words are recorded on tracks 2 through 50 and the abstracts of these groups are recorded in track 1. When searching for a particular group of words, an abstract is generated for the group being sought. This abstract is then compared to the abstracts on track 1 of each card. If any of the abstracts match, the corresponding group of words on the card are searched in detail. For abstracts that do not match there is no need to search the corresponding group of words. Therefore, the need to search every group of words is eliminated, thus increasing the search rate.

The abstracts are generated from the first and third characters of each word in the group of words. Each character to be used in the generation of the abstract is encoded into one of three groups which are equally probable over the distribution of characters in the English Language. The abstract for a group of words consists of the number of characters that fall in each of the three groups.

57 Claims, 34 Drawing Figures



United States Patent [19]
Waggener

[11] **3,984,624**

[45] **Oct. 5, 1976**

- [54] **VIDEO SYSTEM FOR CONVEYING DIGITAL AND ANALOG INFORMATION**
[75] Inventor: **William N. Waggener, Sarasota, Fla.**
[73] Assignee: **Weston Instruments, Inc., Newark, N.J.**
[22] Filed: **July 25, 1974**
[21] Appl. No.: **491,628**

- [52] **U.S. Cl.**..... **178/5.6; 178/DIG. 23; 178/5.8 R**
[51] **Int. Cl.²**..... **H04N 7/08**
[58] **Field of Search**..... **178/5.6, DIG. 23, 5.8 R; 179/15 BY, 15 BW, 15 BM**

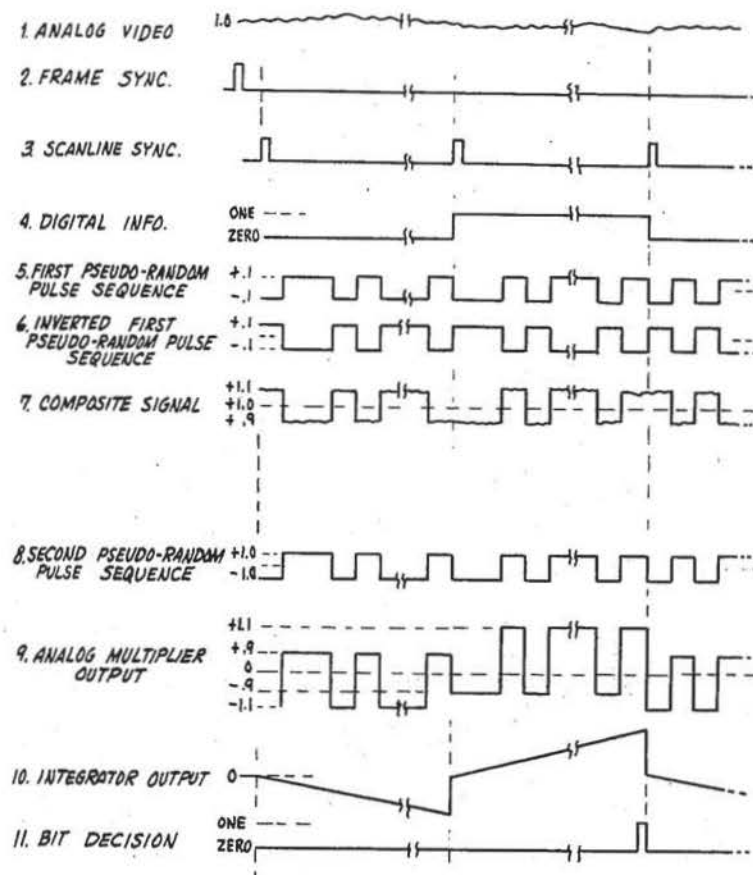
- [56] **References Cited**
UNITED STATES PATENTS
2,624,797 1/1953 Lawson et al..... 178/5.6
3,752,907 8/1973 Mazza..... 178/5.6
3,838,444 9/1974 Loughlin et al..... 179/15 BM
3,842,196 10/1974 Loughlin..... 179/15 BM
3,870,828 3/1975 Saliga..... 179/15 BY

Primary Examiner—John C. Martin
Attorney, Agent, or Firm—William R. Sherman; Kevin McMahon; I. Kavrukov

[57] **ABSTRACT**

A video system having a transmitter in which a composite signal is formed by combining digital information with scanlines of an analog video signal generated by a line scanning device, and a receiver in which the digital information is recovered. The digital information is combined with the analog video signal at predetermined locations along scanlines of the video signal, and these predetermined locations are varied in order to prevent visible deterioration of the video image. In the video receiver, the digital information is recovered by examining the composite signal at the predetermined locations to extract the digital information. Each bit of digital information to be conveyed is represented by a first pseudo-random digital pulse sequence (or its complement, depending on whether the data bit is 1 or 0) which is superimposed on a selected scanline of the analog video signal to form the composite signal. The digital information is recovered at the receiver by generating a second pseudo-random digital pulse sequence in synchronism with the first sequence, and by examining the composite signal at locations determined by the second digital pulse sequence to extract the digital information contained in the composite signal.

51 Claims, 5 Drawing Figures



United States Patent [19]

Adelson

[11] Patent Number: 4,939,515

[45] Date of Patent: Jul. 3, 1990

[54] DIGITAL SIGNAL ENCODING AND DECODING APPARATUS

[75] Inventor: Edward H. Adelson, Cambridge, Mass.

[73] Assignee: General Electric Company, Princeton, N.J.

[21] Appl. No.: 252,223

[22] Filed: Sep. 30, 1988

[51] Int. Cl.⁵ H03M 7/00; H04N 11/04

[52] U.S. Cl. 341/51; 358/13

[58] Field of Search 341/51, 87; 360/32; 358/12, 13

[56] References Cited

U.S. PATENT DOCUMENTS

3,304,372 2/1967 Filipowsky et al. .

4,134,134 1/1979 Lux 341/87

4,237,484 12/1980 Brown et al. .
4,302,775 11/1981 Widergren et al. 341/51
4,394,774 7/1983 Widergren et al. 341/51
4,401,854 8/1983 Steele .
4,495,620 1/1985 Steele et al. .
4,580,162 4/1986 Mori 341/51

Primary Examiner—William M. Shoop, Jr.

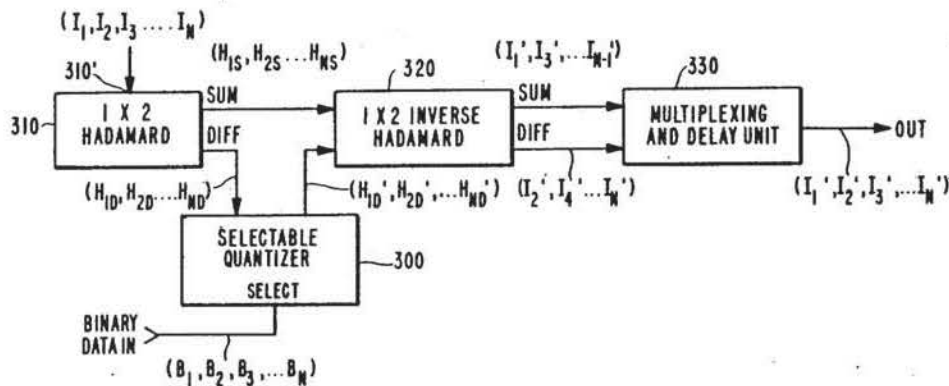
Assistant Examiner—Sharon D. Logan

Attorney, Agent, or Firm—Joseph S. Tripoli; Peter M. Emanuel; Thomas F. Lenihan

[57] ABSTRACT

Digital data is conveyed along with the analog signal by selectively quantizing the analog signal in response to the level of each of the digital bits to be sent. By determining which quantization function was used, a decoder may recover the embedded digital data.

7 Claims, 8 Drawing Sheets



United States Patent [19]

Silverman et al.

[11] Patent Number: 5,077,665

[45] Date of Patent: Dec. 31, 1991

[54] DISTRIBUTED MATCHING SYSTEM

[75] Inventors: David L. Silverman, Nesconset;
Alfred H. Scholldorf, Port Jefferson
Station; Norman Keller, Mt. Sinai, all
of N.Y.

[73] Assignee: Reuters Limited, England

[21] Appl. No.: 357,036

[22] Filed: May 25, 1989

[51] Int. Cl.⁵ G06F 15/20

[52] U.S. Cl. 364/408; 364/401

[58] Field of Search 364/408, 401, 514

[56] References Cited

U.S. PATENT DOCUMENTS

3,573,747	4/1971	Adams et al.	340/172.5
3,581,072	5/1971	Nymeyer	235/152
4,412,287	10/1983	Braddock, III	364/408
4,674,044	6/1987	Kalmus et al.	364/408
4,677,552	6/1987	Sibley, Jr.	364/408
4,745,559	5/1988	Willis et al.	364/514
4,750,135	6/1988	Boilen et al.	364/514
4,868,866	9/1989	Williams, Jr.	380/49

FOREIGN PATENT DOCUMENTS

1489571	10/1977	United Kingdom	364/408
1489573	10/1977	United Kingdom	364/408

Primary Examiner—Jerry Smith

Assistant Examiner—Russell E. Cass

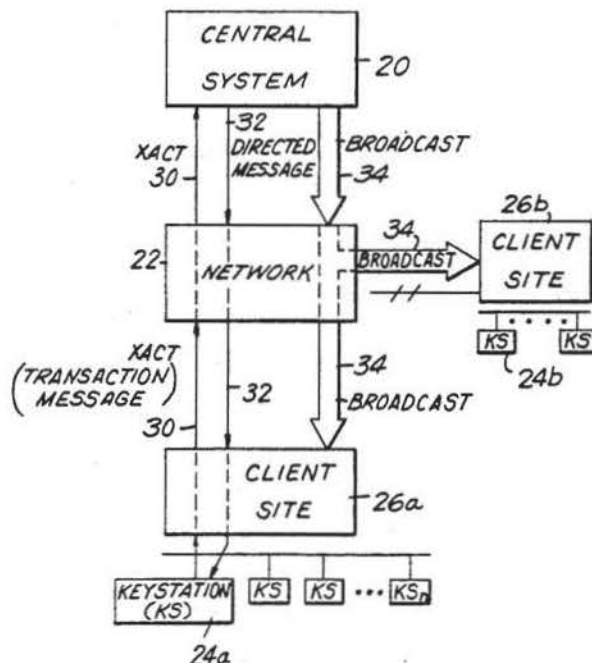
Attorney, Agent, or Firm—Bryan, Cave, McPheeters &
McRoberts

[57] ABSTRACT

A matching system for trading instruments is provided in which bids are automatically matched against offers

for given trading instruments for automatically providing matching transactions in order to complete trades for the given trading instruments in which controllable subsets (110, 112) of a distributable system trading book (118) may be selectively provided to trading keystations (24) in the matching system from the host computer (20) or central system for dynamically controllably masking the available trading market. The system comprises the host computer (20) for maintaining a host book data base (118) comprising all of the active bids and offers in the system by trading instrument, a transaction originating keystation (24a) at a client site (26) for providing a bid on a given trading instrument to the system for providing a potential matching transaction, a counterparty keystation (24b) for providing an offer on the given trading instrument involved in the potential matching transaction, and a network (22) for interconnecting the host computer (20), the transaction originating keystation (24a) and the counterparty keystation (24b) in the system for enabling data communication therebetween. Both the transaction originating keystation (24a) and the counterparty keystation (24b) each have an associated local data base keystation book (110, 112) comprising a subset of the host book (118). The content of each of the keystation books (110, 112) has an associated display depth range which is dynamically controllable by the host computer (20) and is dynamically updatable by transaction update broadcast messages (132) received from the host computer (20) through the network (22) which is preferably transparent to the transactions communicated.

57 Claims, 13 Drawing Sheets





US005136581A

United States Patent [19][11] **Patent Number:** **5,136,581****Muehrcke**[45] **Date of Patent:** **Aug. 4, 1992**

[54] **ARRANGEMENT FOR RESERVING AND ALLOCATING A PLURALITY OF COMPETING DEMANDS FOR AN ORDERED BUS COMMUNICATION NETWORK**

[75] **Inventor:** Eric B. Muehrcke, Middletown, N.J.

[73] **Assignee:** AT&T Bell Laboratories, Murray Hill, N.J.

[21] **Appl. No.:** 546,954

[22] **Filed:** Jul. 2, 1990

[51] **Int. Cl.⁵** H04Q 11/04; H04M 3/42

[52] **U.S. Cl.** 370/62; 370/58.1; 370/85.2; 379/54; 379/202; 379/206

[58] **Field of Search** 370/53, 54, 58.1, 58.2, 370/58.3, 85.1, 85.9, 85.13, 85.14, 62, 85.2; 379/27, 29, 88, 89, 90, 93, 94, 157, 158, 201, 202, 204, 205, 206, 53, 54; 358/85; 364/138, 148, 513, 550

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,710,917 12/1987 Tompkins et al. 370/62
4,796,293 1/1989 Blinks et al. 379/202
4,937,856 6/1990 Natarajan 370/62

OTHER PUBLICATIONS

M. R. Garey et al., *Computers and Intractability—A Guide to the Theory of NP—Completeness*, New York: W. H. Freeman & Co. (1979) pp. 1–44 and 226.

DACS II (Digital Access and Cross-Connect System II)—Reference Manual, AT&T Technologies, Printed in U.S.A. (May 1987) pp. 1–1 to 5–8.

Digital Multipoint Bridge, AT&T Technical Description (undated) pp. 1 to 94.

Rembrandt Video System—User Manual (for T1,

G703/732, RS-422/449 and V.11 Applications) San Jose, Calif. (Aug. 1985), pp. 2–1 to 2–19.

Dataphone® 11 740/741 Acculink™ Multiplexer—Reference Manual, Document No. 999–101–289IS, Issue No. 2, AT&T Printed in U.S.A., (1989), pp. 1–1 to 1N–2.

Primary Examiner—Douglas W. Olms

Assistant Examiner—Alpus H. Hsu

Attorney, Agent, or Firm—B. H. Freedman

[57] **ABSTRACT**

A method and system for allocating a constrained common resource (such as capacity in an ordered bus network) among a plurality of demands for the resource. The allocation arrangement receives from a source, demands for allocating the resource (network) for a particular use, e.g., a conference among a plurality of customer sites, stratifies the received demands in response to a grouping of endpoints to be conferenced at the customer sites, and allocates the network resources to connect the endpoints to be conferenced in response to the stratified demand. This is done by generating setup and terminate times for each endpoint to be connected in a conference; reserving the endpoints to be connected in the conference; and generating a plurality of bindings for signalling the network and the source as to the success of connecting the endpoints to be conferenced over the ordered bus network. The arrangement also stratifies a customer's demand into sets of strategies for groupings of like endpoints; allocates network resources responsive to characteristics of the different groupings of like endpoints; for each strategy, generates the setup times and terminate times for each endpoint, reserves the endpoints for a reservation, and generates bindings. The endpoints may be codecs, alternate accesses, offnets, audio bridges, and/or video conference controllers.

28 Claims, 6 Drawing Sheets

US005394324A

United States Patent [19]

[11] Patent Number: 5,394,324

Clearwater

[45] Date of Patent: Feb. 28, 1995

- [54] AUCTION-BASED CONTROL SYSTEM FOR ENERGY RESOURCE MANAGEMENT IN A BUILDING
- [75] Inventor: Scott H. Clearwater, Woodside, Calif.
- [73] Assignee: Xerox Corporation, Stamford, Conn.
- [21] Appl. No.: 163,061
- [22] Filed: Dec. 8, 1993
- [51] Int. Cl.⁶ G06F 15/20
- [52] U.S. Cl. 364/402; 364/464.01; 364/140; 364/141; 364/408
- [58] Field of Search 364/402, 464.01, 140, 364/141, 505, 550, 408; 236/1 B; 165/2, 13, 14, 58, 59

[56] References Cited

U.S. PATENT DOCUMENTS

- 4,217,646 8/1980 Caltagirone et al. 165/22
- 4,500,034 2/1985 Reese et al. 236/49
- 4,661,914 4/1987 Mulokey et al. 364/505
- 4,918,615 4/1990 Suzuki et al. 364/140

OTHER PUBLICATIONS

- Kenneth Steiglitz and Michael L. Honig, "Chaotic Behavior in an Auction-Based Micro-Economic Model," pp. 1-19, IEEE Transactions on Software Engineering, Feb. 1992, vol. 18, No. 2.
- Ross A. Gagliano et al., "Simulation of a Market Model for Distributed Control," Record of Proceedings, pp. 171-187, The 21st Annual Symposium Mar. 16-18 1988, Tampa, Fla.
- Martin D. Fraser et al., "The Simulation of a Distrib-

- uted Control Model for Resource Allocation and the Implied Pricing," Record of Proceedings, pp. 81-92, The 22nd Annual Symposium Mar. 28-31 1989, Tampa, Fla.
- Martin D. Fraser et al., "Modeling the Cost of Resource Allocation in Distributed Control," Record of Proceedings, pp. 151-164, The 23rd Annual Symposium, Apr. 23-27 1990, Nashville, Tenn.
- James F. Kurose et al., "A Microeconomic Approach to Optimal Resource Allocation in Distributed Computer Systems," IEEE Transactions on Computers, vol. 38, No. 5, May 1989.
- James F. Kurose et al., "A Microeconomic Approach to Decentralized Optimization of Channel Access Policies in Multiaccess Networks," IEEE Publication, pp. 70-77, 1985.

Primary Examiner—Gail O. Hayes

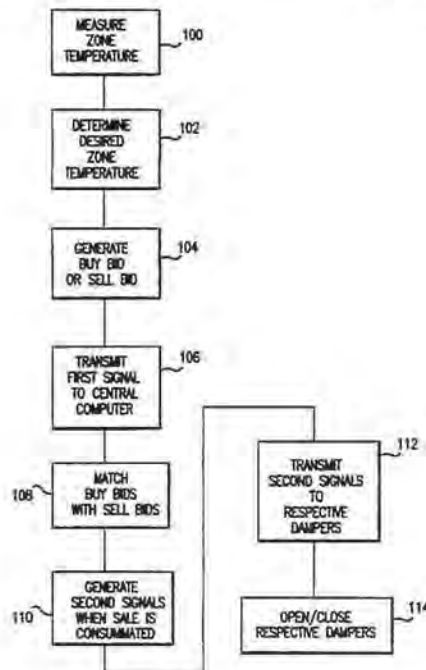
Assistant Examiner—Frantzy Poinvil

Attorney, Agent, or Firm—Oliff & Berridge

[57] ABSTRACT

An auction-based apparatus and method for supplying temperature conditioned air. Each room in an office building makes a bid based on a difference between an actual temperature of the room and a desired temperature of the room. Each room submits the respective bid to a centralized computer that consummates sales based on an auction price. The centralized computer controls the amount of temperature conditioned air supplied to each of the respective rooms based on the consummated sales.

24 Claims, 4 Drawing Sheets



US005379345A

United States Patent [19]

Greenberg

[11] Patent Number: 5,379,345

[45] Date of Patent: Jan. 3, 1995

[54] METHOD AND APPARATUS FOR THE PROCESSING OF ENCODED DATA IN CONJUNCTION WITH AN AUDIO BROADCAST

[75] Inventor: Burton L. Greenberg, New York, N.Y.

[73] Assignee: Radio Audit Systems, Inc., Peekskill, N.Y.

[21] Appl. No.: 11,209

[22] Filed: Jan. 29, 1993

[51] Int. Cl.⁶ H04L 9/00

[52] U.S. Cl. 380/23; 375/1; 380/6; 380/20; 380/31; 380/34; 380/49; 340/825.31; 340/825.34

[58] Field of Search 375/1; 380/34, 6, 20, 380/23, 49, 50, 31, 33; 358/142-147; 340/825.31, 825.34; 348/461-468, 473-486

[56] References Cited

U.S. PATENT DOCUMENTS

2,881,244	4/1959	Pawley et al.	380/20
3,845,391	10/1974	Crosby	380/23 X
4,079,419	3/1978	Siegle et al.	380/20 X
4,313,197	1/1982	Maxemchuk	375/1 X
4,425,661	1/1984	Moses et al.	375/1
4,547,804	10/1985	Greenberg	358/142

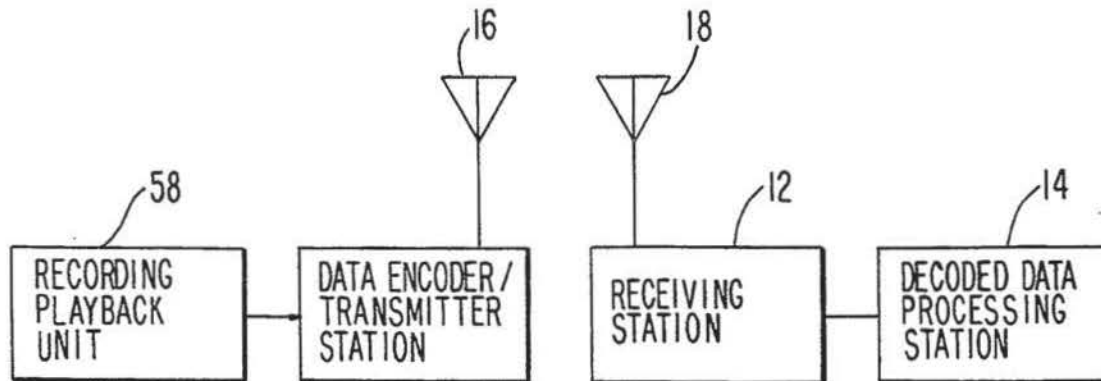
4,639,779	1/1987	Greenberg	358/142
4,805,020	2/1989	Greenberg	358/147
4,945,412	7/1990	Kramer	358/142
4,967,273	10/1990	Greenberg	358/142

Primary Examiner—Bernarr E. Gregory
Attorney, Agent, or Firm—Schweitzer Cornman & Gross

[57] ABSTRACT

A method and apparatus for the identification and verification of audio transmission segments, such as may be broadcast by a radio station, consists of the generation of a data stream corresponding in duration to the length of the program segment and including both cumulative time data and segment identification data. The data stream is combined with the program segment to which it relates in a manner in which the data is inaudible on conventional reception apparatus and which does not significantly degrade the audio quality of the program segment. A reception facility is provided to extract the data stream from the recorded audio and compare the data therein with reference data for the transmission, including intended length and time of the segment. By such a comparison verification of the broadcast can be accomplished.

16 Claims, 2 Drawing Sheets





US005319735A

United States Patent [19]

Preuss et al.

[11] Patent Number: 5,319,735

[45] Date of Patent: Jun. 7, 1994

[54] EMBEDDED SIGNALLING

[75] Inventors: Robert D. Preuss, Boston, Mass.;
Salim E. Roukos, Scarsdale, N.Y.; A.
W. F. Huggins, Arlington, Mass.;
Herbert Gish, Newton, Mass.;
Marcos A. Bergamo, Wellesley,
Mass.; Patrick M. Peterson,
Cambridge, Mass.; Alan G. Derr,
Westford, Mass.

[73] Assignee: Bolt Beranek and Newman Inc.,
Cambridge, Mass.

[21] Appl. No.: 808,913

[22] Filed: Dec. 17, 1991

[51] Int. Cl.⁵ G10L 3/00

[52] U.S. Cl. 395/2.14

[58] Field of Search 375/1, 122; 358/143;
370/110.1; 395/2, 2.1, 2.14; 381/29-40

[56] References Cited

U.S. PATENT DOCUMENTS

3,004,104	10/1961	Hembrooke	370/37
4,395,600	7/1983	Lundy et al.	381/73.1
4,425,661	1/1984	Moses et al.	375/1
4,593,389	6/1986	Wurzburg et al.	370/110.1
4,775,901	10/1988	Nakano	360/60
4,777,529	10/1988	Schultz et al.	358/143
4,903,301	2/1990	Kondo et al.	381/30
4,943,973	7/1990	Werner	375/1
4,965,680	10/1990	Endoh	360/60

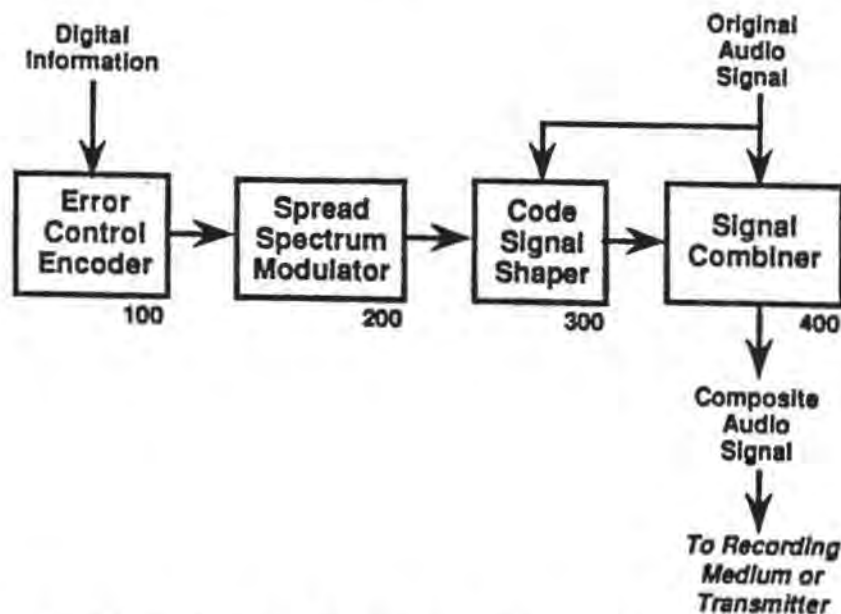
4,972,471	11/1990	Gross et al.	380/3
4,979,210	12/1990	Nagata et al.	380/3
5,212,551	5/1993	Conanan	358/143

Primary Examiner—David D. Knepper
Attorney, Agent, or Firm—Henry D. Pahl, Jr.

[57] ABSTRACT

A code signal representing a sequence of code symbols carrying digital information is generated with the frequency components of the code signal being essentially confined to a preselected signalling band lying within the bandwidth of an audio signal within which the code signal is to be embedded. The audio signal is continuously frequency analyzed over a frequency band encompassing the signalling band and the code signal is dynamically filtered as a function of the analysis thereby to provide a modified code signal with frequency components which are, at each time instant, essentially a preselected small proportion of the levels of the corresponding audio signal frequency components. Accordingly, the modified code signal can be combined with the audio signal to obtain a composite audio signal which is not readily distinguishable from the original audio signal by listening. Furthermore, the digital information can be recovered from the composite audio signal by a procedure which is essentially the complement of that used to obtain the composite audio signal.

25 Claims, 11 Drawing Sheets



Top Level Block Diagram of Information Embedding Process.



US005287407A

United States Patent [19][11] **Patent Number:** **5,287,407****Holmes**[45] **Date of Patent:** **Feb. 15, 1994**[54] **COMPUTER SOFTWARE PROTECTION**[75] **Inventor:** **Keith Holmes, Dublin, Ireland**[73] **Assignee:** **International Business Machines Corporation, Armonk, N.Y.**

2541014 8/1984 France .
 8201273 4/1982 PCT Int'l Appl. .
 8502310 5/1985 PCT Int'l Appl. .
 2154769 9/1985 United Kingdom .

[21] **Appl. No.:** **704,757**[22] **Filed:** **May 23, 1991**[30] **Foreign Application Priority Data**

May 31, 1990 [EP] European Pat. Off. 90305964.0

[51] **Int. Cl.⁵** **H04L 9/00**[52] **U.S. Cl.** **380/4**[58] **Field of Search** **380/4**[56] **References Cited****U.S. PATENT DOCUMENTS**

4,748,562 5/1988 Brown 364/
 4,866,769 9/1989 Karp 380/4
 4,903,296 2/1990 Chandra et al. 380/4
 4,979,210 12/1990 Nagata et al. 380/4
 5,027,396 6/1991 Platteter et al. 380/4
 5,027,398 6/1991 Miyoshi 380/4

FOREIGN PATENT DOCUMENTS

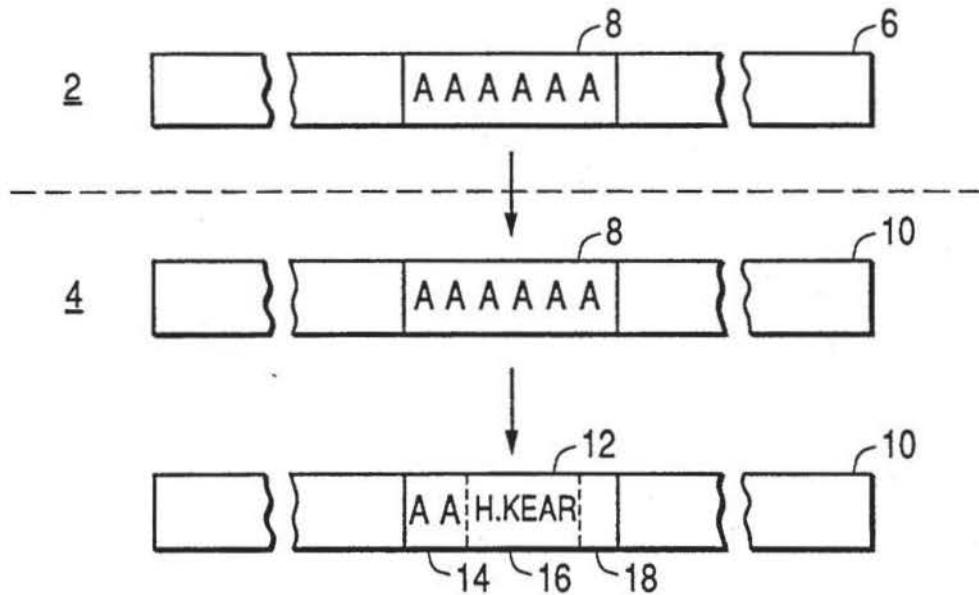
302710 2/1989 European Pat. Off. .

OTHER PUBLICATIONS

IBM Technical Disclosure Bulletin, vol. 28, No. 2 Jul. 1985 "Computer Program Identification".

Primary Examiner—David Cain*Attorney, Agent, or Firm*—Lauren C. Bruzzone; Jesse L. Abzug[57] **ABSTRACT**

A master copy of a software file has within it a predetermined block of data. When a copy of the file is made that block of data within the copied file is located and overwritten with data identifying the copied file. When an unauthorized copy is found, the data identifying the copy can be read and the source of the unauthorized copy may be traced. The invention is particularly suited to use with software distribution over a computer network in which details such as the time the copied file was made and the name of the authorized user can be embedded within the copy.

13 Claims, 1 Drawing Sheet



US005243423A

United States Patent [19]
DeJean et al.

[11] **Patent Number:** 5,243,423
[45] **Date of Patent:** Sep. 7, 1993

[54] **SPREAD SPECTRUM DIGITAL DATA TRANSMISSION OVER TV VIDEO**

[75] **Inventors:** Jean P. DeJean, Cincinnati, Ohio;
Daosheng Lu, Buffalo Grove, Ill.;
Robert Weissman, Westport, Conn.

[73] **Assignee:** A. C. Nielsen Company, Northbrook, Ill.

[21] **Appl. No.:** 811,805

[22] **Filed:** Dec. 20, 1991

[51] **Int. Cl.⁵** H04N 7/08

[52] **U.S. Cl.** 358/142; 358/141

[58] **Field of Search** 358/142, 141, 167; 375/1

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,244,808	4/1966	Roberts	
3,562,420	2/1971	Thompson	
3,838,444	9/1974	Loughlin et al.	358/142
3,842,196	10/1974	Loughlin	358/142
3,984,624	10/1976	Waggener	358/142
4,363,138	12/1982	Franklin et al.	
4,425,642	1/1984	Moses et al.	
4,841,545	6/1989	Endo et al.	375/1

4,912,721 3/1990 Pidgeon, Jr. et al. .
4,969,041 11/1990 O'Grady et al. 358/142

OTHER PUBLICATIONS

Spread Spectrum Goes Commercial by D. L. Schilling, R. L. Pickholtz, and L. B. Mistein, IEEE Spectrum Magazine, Aug. 1990, pp. 40-46.

Primary Examiner—James J. Groody

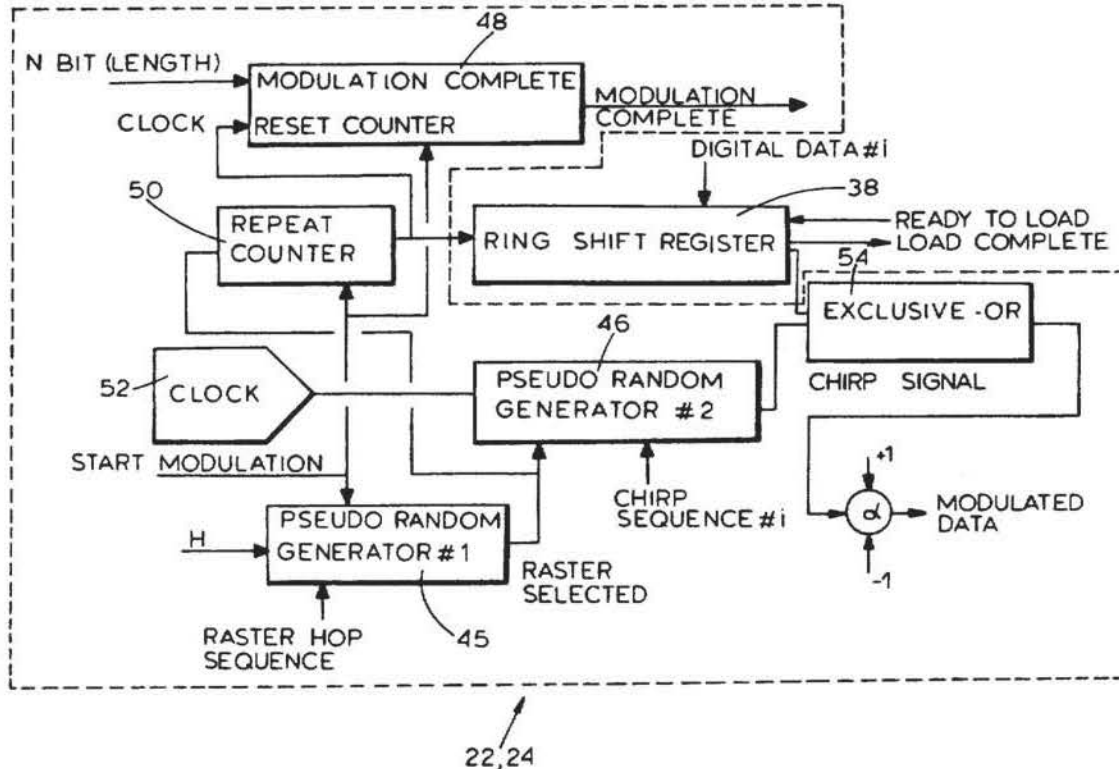
Assistant Examiner—David E. Harvey

Attorney, Agent, or Firm—Marshall, O'Toole, Gerstein, Murray & Borun

[57] **ABSTRACT**

A co-channel communication system allows transmission of one or more data signals in an active or visible portion of a video raster in a manner that is imperceptible to a viewer. More particularly, the data signal is transmitted over a preselected active video lines of a video raster. In order to reduce the perceptibility of the data signal, the video lines over which the data signal is transmitted is varied according to a random sequence. In an alternate embodiment, the data is also modulated at relatively low modulation levels, for example, by converting the data signal to a spread spectrum signal.

17 Claims, 4 Drawing Sheets



US005161210A

United States Patent [19][11] **Patent Number:** **5,161,210****Druyvesteyn et al.**[45] **Date of Patent:** **Nov. 3, 1992**

[54] **CODER FOR INCORPORATING AN AUXILIARY INFORMATION SIGNAL IN A DIGITAL AUDIO SIGNAL, DECODER FOR RECOVERING SUCH SIGNALS FROM THE COMBINED SIGNAL, AND RECORD CARRIER HAVING SUCH COMBINED SIGNAL RECORDED THEREON.**

[75] **Inventors:** Willem F. Druyvesteyn; Abraham Hoogendoorn; Leon M. Van De Kerkhof; Raymond N. J. Veldhuis, all of Eindhoven, Netherlands.

[73] **Assignee:** U.S. Philips Corporation, New York, N.Y.

[21] **Appl. No.:** 433,631

[22] **Filed:** Nov. 8, 1989

[30] **Foreign Application Priority Data**

Nov. 10, 1988 [NL] Netherlands 8802769
Apr. 25, 1989 [NL] Netherlands 8901032

[51] **Int. Cl.⁵** G10L 9/00; G10L 7/04

[52] **U.S. Cl.** 395/2; 381/31

[58] **Field of Search** 381/29-40;
395/2

[56] **References Cited**

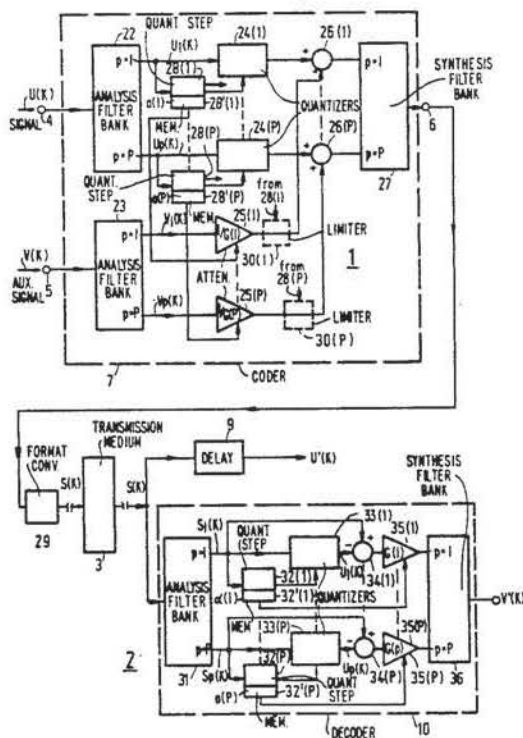
U.S. PATENT DOCUMENTS

4,455,649 6/1984 Esteban et al. 381/29
4,535,472 8/1985 Tomcik 381/31
4,703,480 10/1987 Westall et al. 381/30
4,903,301 2/1990 Konido et al. 381/30

Primary Examiner—Allen R. MacDonald
Assistant Examiner—David D. Knepper
Attorney, Agent, or Firm—Leroy Eason

[57] **ABSTRACT**

The audio signal is divided into frequency sub-bands, the sub-band samples are quantized according to a pre-determined quantizing criterion, and the quantized samples in one or more sub-bands are summed with samples of the auxiliary signal in such sub-bands, the auxiliary signal sample in a sub-band having a maximum amplitude less than half the quantization step used in such sub-band. The combined signal, covering the entire frequency band of the audio signal, can be transmitted or recorded on a record carrier. Upon audio reproduction at a receiver only the audio signal will be audible, the auxiliary signal being masked due to the psycho-acoustic characteristics of the human auditory system which are unresponsive to low-level noise in the presence of high amplitude sound. The receiver includes a decoder which analyzes the combined signal into the original frequency sub-bands and re-quantizes the sub-band signals using the same quantizing criterion as at the coder. The auxiliary signal is reconstructed by subtracting the quantized signal sample in each sub-band from the non-quantized signal sample therein and combining the non-quantized sub-band signal sample. The auxiliary signal may be a copy inhibit code which serves to inhibit a recorder from recording the audio signal, thus protecting against unauthorized copying.

14 Claims, 6 Drawing Sheets

US007058570B1

(12) **United States Patent**
Yu et al.(10) **Patent No.:** **US 7,058,570 B1**
(45) **Date of Patent:** **Jun. 6, 2006**(54) **COMPUTER-IMPLEMENTED METHOD AND APPARATUS FOR AUDIO DATA HIDING**(75) Inventors: **Hong Heather Yu**, Plainsboro, NJ (US); **Xin Li**, Princeton, NJ (US)(73) Assignee: **Matsushita Electric Industrial Co., Ltd.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/499,525**(22) Filed: **Feb. 10, 2000**(51) **Int. Cl.**
G10L 19/04 (2006.01)(52) **U.S. Cl.** **704/219**(58) **Field of Classification Search** 704/270, 704/221, 222, 219, 258; 382/100; 713/176
See application file for complete search history.(56) **References Cited****U.S. PATENT DOCUMENTS**

5,355,416	A	10/1994	Sacks	
5,621,772	A	4/1997	Maturi et al.	
5,848,155	A	12/1998	Cox	
5,889,868	A	3/1999	Moskowitz et al.	
5,893,067	A	4/1999	Bender et al.	
6,233,347	B1 *	5/2001	Chen et al.	382/100
6,278,791	B1 *	8/2001	Honsinger et al.	382/100
6,442,283	B1 *	8/2002	Tewfik et al.	382/100
6,480,825	B1 *	11/2002	Sharma et al.	704/270
6,678,389	B1 *	1/2004	Sun et al.	382/100

6,834,344 B1 * 12/2004 Aggarwal et al. 713/176

OTHER PUBLICATIONS

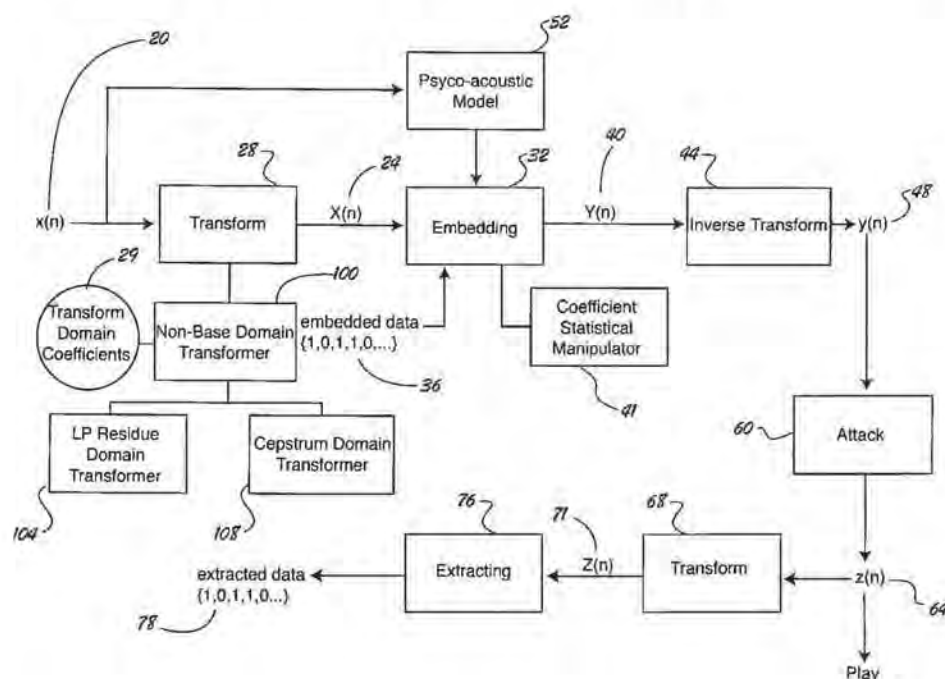
Kim, Won-Gyum et al., "An Audio Watermarking Scheme Robust to MPEG Audio Compression" Proceedings of the IEEE-Eurasip Workshop on Nonlinear Signal and Image Processing, vol. 1, 1999, pp. 326-330, XP000979677, no month found.

Sang-Kwang Lee et al., "Digital Audio Watermarking in the Cepstrum Domain" International Conference on Consumer Electronics. Digest of Technical Papers, Jun. 2000, pp. 334-335, XP000952156.

(Continued)

Primary Examiner—Wayne Young
Assistant Examiner—Jakieda R. Jackson(74) *Attorney, Agent, or Firm*—Harness, Dickey & Pierce, PLC(57) **ABSTRACT**

A computer-implemented method and apparatus for embedding hidden data in an audio signal. An audio signal is received in a base domain and then transformed into a non-base domain, such as cepstrum domain or LP residue domain. The statistical mean manipulation is employed on selected transform coefficients to embed hidden data. The introduced distortion is controlled by psychoacoustic model to ensure the imperceptibility of the embedded hidden data. Scrambling techniques can be plugged in to further increase the security of the data hiding system. The present new audio data hiding scheme provides transparent audio quality, sufficient embedding capacity, and high survivability over a wide range of common signal processing attacks.

23 Claims, 5 Drawing Sheets



(12) **United States Patent**
Binding et al.

(10) **Patent No.:** **US 6,775,772 B1**
(45) **Date of Patent:** **Aug. 10, 2004**

(54) **PIGGY-BACKED KEY EXCHANGE
PROTOCOL FOR PROVIDING SECURE
LOW-OVERHEAD BROWSER
CONNECTIONS FROM A CLIENT TO A
SERVER USING A TRUSTED THIRD PARTY**

(75) **Inventors:** **Carl Binding**, Thalwil (CH); **Stefan
Georg Hild**, Adliswil (CH); **Luke
James O'Connor**, Asliswil (CH);
Sandeep K. Singhal, Raleigh, NC
(US); **Victor John Shoup**, Zurich (CH);
Michael Steiner, Saarbruecken (DE)

(73) **Assignee:** **International Business Machines
Corporation**, Armonk, NY (US)

(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **09/415,827**

(22) **Filed:** **Oct. 12, 1999**

(51) **Int. Cl.** **H04L 9/00**

(52) **U.S. Cl.** **713/171; 713/151; 713/152;
713/200; 380/279; 709/220; 709/228; 709/230;
709/310; 709/315; 345/804**

(58) **Field of Search** **709/220, 228,
709/230, 310, 315; 713/151, 152, 171,
200; 345/804; 380/279**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,673,322	A	*	9/1997	Pepe et al.	705/52
5,708,780	A	*	1/1998	Levergood et al.	709/229
5,754,772	A	*	5/1998	Leaf	709/203
5,793,966	A	*	8/1998	Amstein et al.	709/203
5,825,890	A	*	10/1998	Elgamal et al.	713/151
5,875,296	A	*	2/1999	Shi et al.	713/202
5,923,756	A	*	7/1999	Shambroom	713/156
5,978,840	A	*	11/1999	Nguyen et al.	709/217
6,061,790	A	*	5/2000	Bodnar	713/171
6,092,196	A	*	7/2000	Reiche	713/200

6,182,142	B1	*	1/2001	Win et al.	709/229
6,226,752	B1	*	5/2001	Gupta et al.	713/201
6,643,774	B1	*	11/2003	McGarvey	713/155

OTHER PUBLICATIONS

Takahiko Kiuchi, Shigekoto Kaihara, "C-HTTP, The Development of a Secure, Closed HTTP-based on Network the Internet," Proceedings of SNDSS '96, IEEE 1996.*

E. Rescorla, A. Schiffman, "The Secure Hypertext Transfer Protocol," Network Working Group, RFC: 2660, Aug. 1999.*

Bellovin, Moskowitz, "Client Certificate and Key Retrieval for IKE," Network Working Group, Internet Draft, Nov. 2000.*

R. Fielding et al., "Hypertext Transfer Protocol HTTP/1.1," Network Working Group, RFC: 208, Jan. 1997.*

Kuichi et al., C-HTTP: The Development of a Secure, Closed HTTP-based Network on the Internet, Proceedings of the SNDSS '96, IEEE 1996, pp. 64-75.*

* cited by examiner

Primary Examiner—Gregory Morse

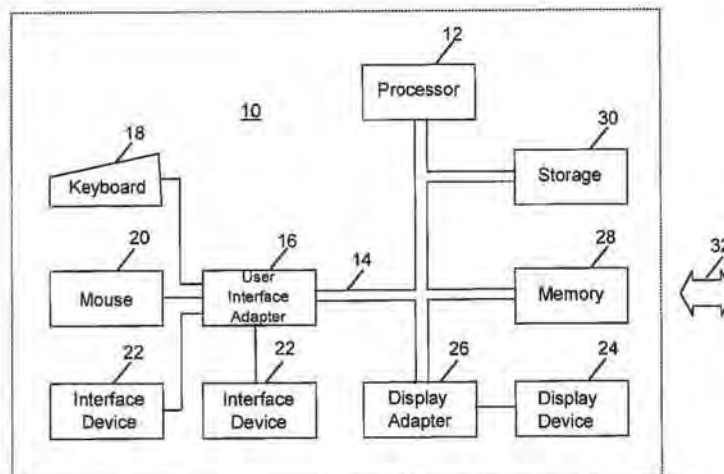
Assistant Examiner—Paul E. Callahan

(74) *Attorney, Agent, or Firm*—A. Bruce Clay; Marcia L. Doubet

(57) **ABSTRACT**

A method, system, and computer program product for establishing security parameters that are used to exchange data on a secure connection. A piggy-backed key exchange protocol is defined, with which these security parameters are advantageously exchanged. By piggy-backing the key exchange onto other already-required messages (such as a client's HTTP GET request, or the server's response thereto), the overhead associated with setting up a secure browser-to-server connection is minimized. This technique is defined for a number of different scenarios, where the client and server may or may not share an encoding scheme, and is designed to maintain the integrity of application layer communication protocols. In one scenario, a client and a server exchange secure messages using a trusted third party.

67 Claims, 3 Drawing Sheets



US006539475B1

(12) **United States Patent**
Cox et al.

(10) **Patent No.:** **US 6,539,475 B1**
(45) **Date of Patent:** **Mar. 25, 2003**

(54) **METHOD AND SYSTEM FOR PROTECTING DIGITAL DATA FROM UNAUTHORIZED COPYING**

(75) Inventors: **Ingemar J. Cox**, Lawrenceville, NJ (US); **Matthew L. Miller**, Princeton, NJ (US)

(73) Assignee: **NEC Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/215,960**

(22) Filed: **Dec. 18, 1998**

(51) Int. Cl.⁷ **H04N 7/16; H04N 7/167; H04L 9/28**

(52) U.S. Cl. **713/100; 713/176; 713/193; 705/57; 380/201; 380/202; 380/203**

(58) Field of Search **713/176, 193; 380/201-203; 705/57**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,319,735 A 6/1994 Preuss et al.
5,574,787 A * 11/1996 Ryan 380/5
5,687,191 A 11/1997 Lee et al.

5,708,717 A 1/1998 Alasia
5,745,569 A * 4/1998 Moskowitz et al. 380/23
5,809,139 A * 9/1998 Girod et al. 380/5
5,838,791 A 11/1998 Torii et al.
5,848,155 A 12/1998 Cox

* cited by examiner

Primary Examiner—Gail Hayes

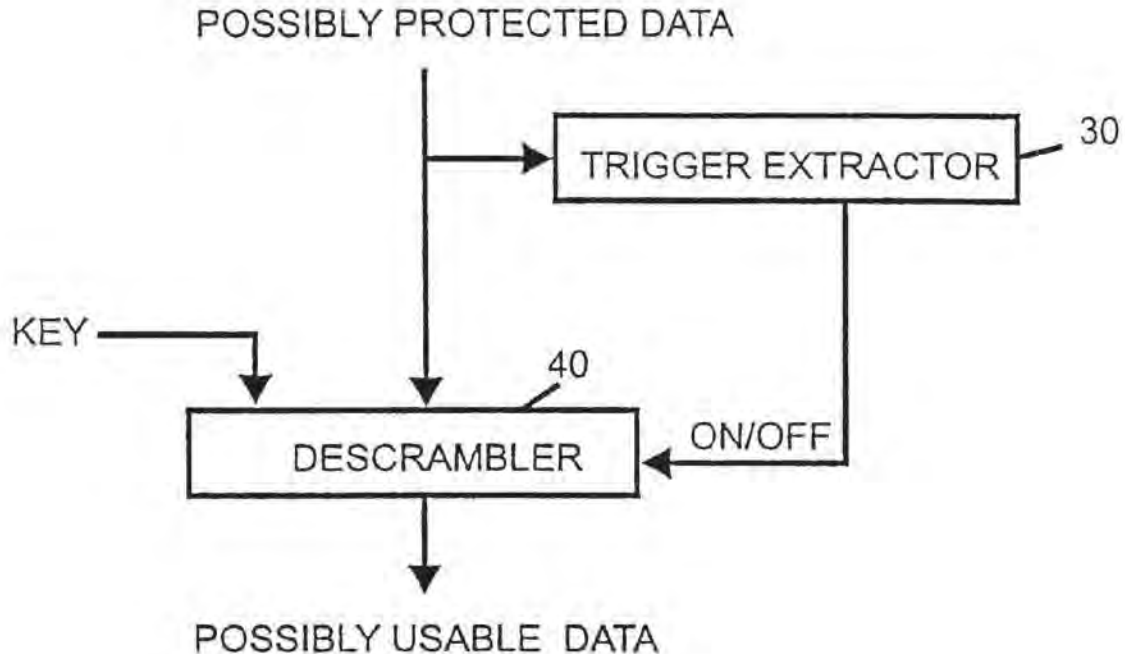
Assistant Examiner—Taghi T. Arani

(74) Attorney, Agent, or Firm—Scully, Scott, Murphy & Presser

(57) **ABSTRACT**

Data is protected from unauthorized copying by resampling an unauthorized version of the data, but descrambling an authorized version of the data. This is done using a trigger signal. One property of the trigger signal is that it is preserved through signal transformations, such as one or more of compression, decompression, analog to digital conversion, and digital to analog conversion. As a result of this property the trigger signal can be detected in either scrambled or descrambled data. The trigger signal is embedded into the data to form watermarked data. The watermarked data is passed through a descrambler, where the trigger signal, if present, is extracted. A descrambling key and a descrambling algorithm are applied to the watermarked data if the trigger signal is present, but not applied to the watermarked data if the trigger signal is not present.

12 Claims, 3 Drawing Sheets



US006530021B1

(12) **United States Patent**
Epstein et al.(10) **Patent No.:** **US 6,530,021 B1**
(45) **Date of Patent:** **Mar. 4, 2003**(54) **METHOD AND SYSTEM FOR PREVENTING
UNAUTHORIZED PLAYBACK OF
BROADCASTED DIGITAL DATA STREAMS**(75) Inventors: **Michael Epstein**, Spring Valley, NY
(US); **Michael Pasieka**, Thornwood,
NY (US)(73) Assignee: **Koninklijke Philips Electronics N.V.**,
Eindhoven (NL)(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.(21) Appl. No.: **09/323,808**(22) Filed: **Jun. 2, 1999****Related U.S. Application Data**(60) Provisional application No. 60/093,402, filed on Jul. 20,
1998.(51) **Int. Cl.**⁷ **G06F 1/24**(52) **U.S. Cl.** **713/176; 713/161; 713/168;**
713/170(58) **Field of Search** 713/161, 168,
713/170, 176, 200, 201(56) **References Cited****U.S. PATENT DOCUMENTS**

6,122,403	A *	9/2000	Rhoads	382/233
6,131,162	A *	10/2000	Yoshiura et al.	380/28
6,216,228	B1 *	4/2001	Chapman et al.	380/206
6,233,347	B1 *	5/2001	Chen et al.	382/100
6,396,937	B2 *	5/2002	Chen et al.	382/100

FOREIGN PATENT DOCUMENTS

EP	0716544	12/1995	H04N/5/913
EP	0750423	6/1996	H04N/7/167
EP	0859503	8/1998	H04N/1/00

WO	WO9743853	5/1997	H04N/5/913
WO	WO9724832	7/1997	H04L/9/14
WO	WO9833325	1/1998	H04N/7/50
WO	WO9824236	6/1998	H04N/7/167

OTHER PUBLICATIONS

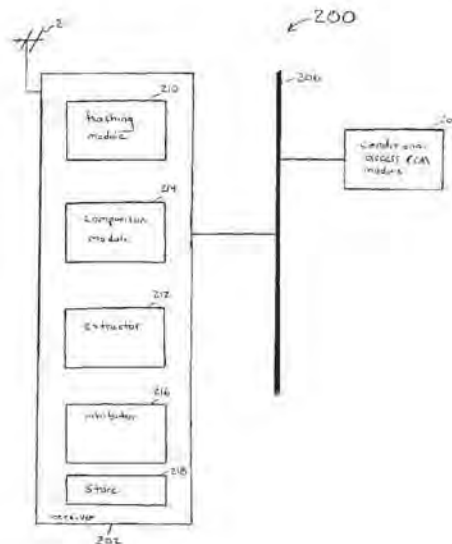
Linnartz et al., "Philips Electronics response to call for proposals issued by the Data Hiding Subgroup copy protection technical working subgroup", Online, 1997, XP002118336, Retrieved from the Internet: \leq URL: http://www.dvcc.com/dhsg_filename_philips_dhsg.rtf "Proposals".

Sections II.a "Basic system concept" and II.b Authorization ticket: a cryptographically secured CGMS system of section II "Copy-control system concept".

* cited by examiner

Primary Examiner—Thomas R. Peeso(74) *Attorney, Agent, or Firm*—Daniel J. Piotrowski(57) **ABSTRACT**

A method and system are provided for preventing the unauthorized playback of broadcasted digital data streams. The method includes the step of embedding a watermark in a digital data stream. The digital data stream having the embedded watermark is encrypted. The encrypted digital data stream is broadcasted with a ticket. The encrypted digital data stream and the ticket are received. The ticket is saved and the encrypted digital data stream is provided to a decryption device to decrypt the digital data stream. The decrypted digital data stream is received from the decryption device. The watermark is extracted from the decrypted digital data stream. A one-way cryptographic hashing function is applied to the saved ticket. The hashed ticket is compared to the extracted watermark. Playback of the digital data stream is prevented, when the hashed ticket does not match the extracted watermark.

11 Claims, 3 Drawing Sheets

US006493457B1

(12) **United States Patent**
Quackenbush et al.(10) **Patent No.:** **US 6,493,457 B1**
(45) **Date of Patent:** **Dec. 10, 2002**(54) **ELECTRONIC WATERMARKING IN THE
COMPRESSED DOMAIN UTILIZING
PERCEPTUAL CODING**(75) **Inventors:** **Schuyler Reynier Quackenbush**,
Westfield, NJ (US); **Amy Ruth
Reihman**, Matawan, NJ (US); **David
Hilton Shur**, Aberdeen, NJ (US);
James H. Snyder, North Plainfield, NJ
(US)(73) **Assignee:** **AT&T Corp.**, New York, NY (US)(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.(21) **Appl. No.:** **09/192,359**(22) **Filed:** **Nov. 16, 1998****Related U.S. Application Data**(60) Provisional application No. 60/067,225, filed on Dec. 3,
1997.(51) **Int. Cl.**⁷ **G06K 9/00**(52) **U.S. Cl.** **382/100; 382/232; 382/251;**
380/252; 380/287; 713/176(58) **Field of Search** **382/100, 232,**
382/239, 251; 380/210, 252, 287, 54; 713/176;
704/200.1, 273; 381/73.1; 348/460, 463(56) **References Cited****U.S. PATENT DOCUMENTS**4,939,515 A 7/1990 Adelson
5,530,759 A 6/1996 Braudaway et al.

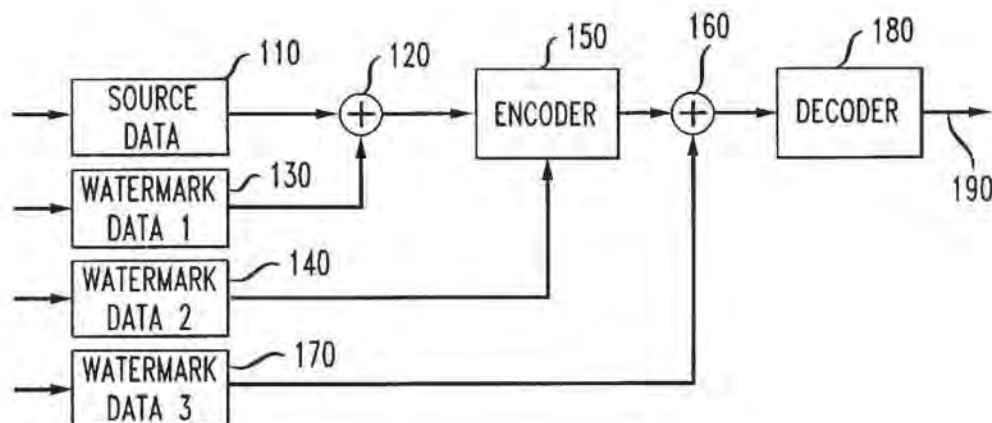
(List continued on next page.)

FOREIGN PATENT DOCUMENTSEP 0 663 773 A2 7/1995
EP 0 663 773 A3 7/1995
EP 0 705 025 4/1996
EP 0 851 679 7/1998**OTHER PUBLICATIONS**Bin Zhu and Ahmed Tewfik; Media Compression via Data
Hiding; Signals, Systems, & Computers; 1997; Conference
Recor Thirty-First Asilomar Conference on pp. 647-651;
vol. 1; Nov. 2-5, 1997.*

(List continued on next page.)

Primary Examiner—Joseph Mancuso*Assistant Examiner*—Anand Bhatnagar(74) *Attorney, Agent, or Firm*—Banner & Witcoff, Ltd.(57) **ABSTRACT**

A method and apparatus are described for inserting a watermark in the compressed domain. The watermark inserted does not require a reference. An overall watermarking system incorporating the invention combines cleartext, bitstream, and integrated watermarking. In a perceptual coder, the data enters a filterbank, where it is processed into multiple separate coefficients. A rate/distortion control module uses noise threshold information from a perceptual coder, together with bit-count information from a noiseless coder, to compute scale factors. The coefficients are multiplied by the scale factors and quantized, then noiseless coded and then output for further processing/transmission. The invention supports three embodiments for inserting a mark into the bitstream imperceptibly. It is assumed that some set of scale factor bands have been selected, into which mark data will be inserted. In one embodiment, a set of multipliers $\{x_i = 2^{N_i}; i \in M\}$ is chosen. Each triple is modified by dividing the scale factor by x_i , multiplying the quantized coefficients by $\{x_i\}$, and adding mark data to the non-zero modified quantized coefficients. In an alternate embodiment, watermark data is represented via two characteristics of the bitstream data. A Huffman table is selected for encoding the Scale Factor Band receiving watermark data which is not the table that would normally be used. The watermark data bit is set according to any desired scheme, and the quantized coefficients are derived using the alternate Huffman table. In another embodiment, watermarking is integrated with quantization. The watermark is therefore difficult to remove without perceptible effects. The fact that marking data is present is again indicated by characteristics of the bitstream data. The modification factors $\{x_i\}$ are now all close to unity.

42 Claims, 5 Drawing Sheets

US006381618B1

(12) **United States Patent**
Jones et al.

(10) **Patent No.:** **US 6,381,618 B1**
 (45) **Date of Patent:** **Apr. 30, 2002**

(54) **METHOD AND APPARATUS FOR AUTOSYNCHRONIZING DISTRIBUTED VERSIONS OF DOCUMENTS**

(75) Inventors: **Jeffrey Allen Jones**, Round Rock;
Michael Wayne Brown, Georgetown,
 both of TX (US)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/335,286**

(22) Filed: **Jun. 17, 1999**

(51) Int. Cl.⁷ **G06F 17/00**

(52) U.S. Cl. **707/203; 707/10; 709/201**

(58) Field of Search **707/1-10, 100-104, 707/200-206; 709/100-332**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,625,818 A 4/1997 Zarmer et al. 707/200
 5,684,984 A 11/1997 Jones et al. 707/10
 5,694,597 A * 12/1997 Cantin et al. 707/103
 5,835,908 A * 11/1998 Bennett et al. 707/10
 5,842,214 A * 11/1998 Whitney et al. 707/10

OTHER PUBLICATIONS

Sivaram et al., "Architectural support for efficient multicasting in irregular networks", Parallel and Distributed Systems, IEEE Transactions on, vol. 12, Issue 5, May 2001, pp. 489-513.*

Ghosh et al., "Quality-of-service routing in IP networks", Multimedia, IEEE Transactions on, Jun. 2001, vol. 3, Issue 2, pp. 200-208.*

Shaikh et al., "Evaluating the impact of stale link state on quality-of-service routing" Networking, IEEE/ACM Transactions on, vol. 9, Issue 2, Apr. 2001, pp. 162-176.*

* cited by examiner

Primary Examiner—Thomas Black

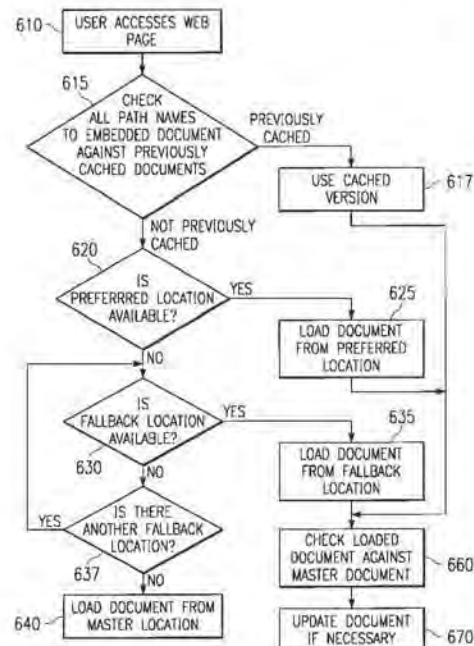
Assistant Examiner—David Jung

(74) *Attorney, Agent, or Firm*—Duke W. Yee; Jeffrey S. LaBaw; Stephen R. Loe

(57) **ABSTRACT**

Synchronizing copies of a first document in a distributed computing environment. According to a preferred embodiment, a path to a preferred repository for the first document and a path to a master repository for the first document are embedded in a second document. A copy of the first document is retrieved from the preferred repository. The master repository is checked to determine whether the retrieved copy is a copy of a most recent version of the first document. In response to the determination that the retrieved copy is the most recent version of the first document, the second document is formatted using the retrieved copy.

26 Claims, 7 Drawing Sheets



US006330672B1

(12) **United States Patent**
Shur(10) **Patent No.:** **US 6,330,672 B1**
(45) **Date of Patent:** ***Dec. 11, 2001**(54) **METHOD AND APPARATUS FOR WATERMARKING DIGITAL BITSTREAMS**(75) **Inventor:** **David Hilton Shur, Aberdeen, NJ (US)**(73) **Assignee:** **AT&T Corp., New York, NY (US)**(*) **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **09/108,135**(22) **Filed:** **Jun. 30, 1998****Related U.S. Application Data**

(60) Provisional application No. 60/067,225, filed on Dec. 3, 1997.

(51) **Int. Cl.:** **H04L 9/00**(52) **U.S. Cl.:** **713/176; 380/54; 382/251**(58) **Field of Search:** **713/176; 380/54; 380/202; 705/51, 57, 58; 382/251, 100**(56) **References Cited****U.S. PATENT DOCUMENTS**

5,664,018 * 9/1997 Leighton 380/54
 5,724,277 * 3/1998 Nakagawa 708/320
 5,745,569 * 4/1998 Moskowitz et al. 705/58
 5,889,868 * 3/1999 Moskowitz et al. 713/176
 5,905,800 * 5/1999 Moskowitz et al. 380/28
 6,064,764 * 5/2000 Bhaskaran et al. 382/183

FOREIGN PATENT DOCUMENTS

WO 9929114 * 6/1999 (WO) .

OTHER PUBLICATIONS

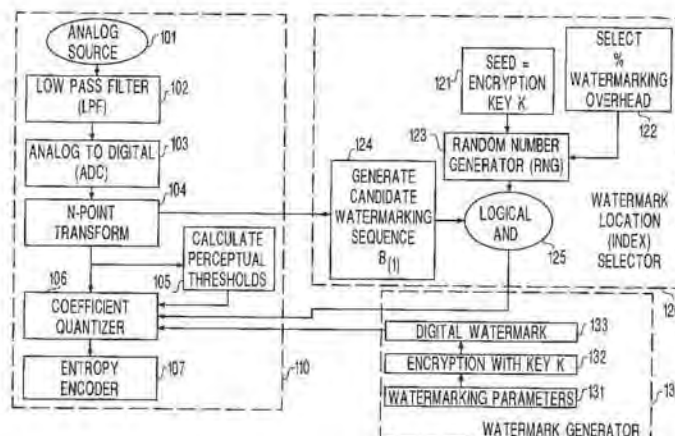
Schneier, "Applied Cryptography, 2nd Edition," pp. 372-379, 436-441, 454-455, and 574-577, 1996.*
 Stephen S. Lavenberg, "Computer Performance Modeling Handbook", Chapter 5, Generation Methods for Discrete Event Simulation, pp. 223-245pp. 218-226, 1983.

* cited by examiner

Primary Examiner—Albert Decady
Assistant Examiner—Steve Kabakoff

(57) **ABSTRACT**

A signal is encoded, for example, perceptually and, during or after the perceptual coding process, a digital watermark is inserted into a quantized digital information signal resulting from the perceptual coding process in such a manner that its insertion is imperceptible to one later listening to, displaying or otherwise utilizing the information signal. Moreover, the digital watermark may be inserted in accordance with a key indicative of the location of the mark in the digitally encoded signal. The key may be protected with a trusted entity and distributed in such a manner as to be not detectable by a pirate. Consequently, the key may be utilized at watermarking apparatus that can be located anywhere in the distribution channel of a copyright protected work. The key may be embedded in a secure microprocessor of validating apparatus at a point of distribution or even at a point of sale. In this manner, when or after a digital bitstream is fixed in a medium of expression or broadcast, the watermark can be applied at the time of fixing in a copy, thus validating an original legitimate copy. For example, a compact disc recording may be validated at the point of sale as an authorized copy through watermarking (validating) apparatus according to the present invention or, at the time of broadcast over radio frequencies or distribution via the Internet, information may be watermarked. In this manner, even though a work may be pirated, further information may be included or otherwise indicated by the watermark to assist in, not only recognizing a pirated work and the original from which the pirate copy was produced, but the identity of the pirate who later makes an unauthorized copy of the original.

36 Claims, 4 Drawing Sheets

US006285775B1

(12) **United States Patent**
Wu et al.(10) **Patent No.:** **US 6,285,775 B1**
(45) **Date of Patent:** **Sep. 4, 2001**(54) **WATERMARKING SCHEME FOR IMAGE AUTHENTICATION**(75) Inventors: **Min Wu; Bede Liu**, both of Princeton, NJ (US)(73) Assignee: **The Trustees of the University of Princeton**, Princeton, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/164,474**(22) Filed: **Oct. 1, 1998**(51) Int. Cl.⁷ **G06K 9/00**(52) U.S. Cl. **382/100**(58) Field of Search 382/100, 232;
380/28, 29, 30, 54; 705/51(56) **References Cited****U.S. PATENT DOCUMENTS**

5,530,759	*	6/1996	Braudaway et al.	380/54
5,721,788		2/1998	Powell	382/100
5,778,102	*	7/1998	Standford, II et al.	382/251
5,875,249		2/1999	Mintzer et al.	380/54
5,930,369	*	7/1999	Cox et al.	380/54
5,960,081	*	9/1999	Vynne et al.	713/176
6,061,793	*	5/2000	Tewfik et al.	713/176

OTHER PUBLICATIONSBYTE Magazine, "How to Embed a Watermark", Jan. 1997, 1 page (<http://www.byte.com/art/970/sec18/art3.htm>).Ahumada, Jr., "Luminance-Model-Based DCT Quantization for Color Image Compression", *SPIE Human Vision, Visual Processing, and Digital Display III*, 1992, 1666, 365-374.Friedman, G.L., "The trustworthy Digital Camera: Restoring Credibility to the Photographic Image", *IEEE Trans. on Consumer Electronics*, Nov. 1993, 39(4), 905-910.Kesavan, H., "EE 392c Autumn 1997 Final Project: Choosing a DCT Quantization Matrix for JPEG Encoding", <http://www-ise.stanford.edu/class/ee392c/demos/kesavan/>, Jul. 1998, 5 pages.Koch, E. et al., "Towards Robust and Hidden Image Copyright Labeling", *IEEE Workshop on Nonlinear Signal and Image Processing*, 1995, 1-4.

(List continued on next page.)

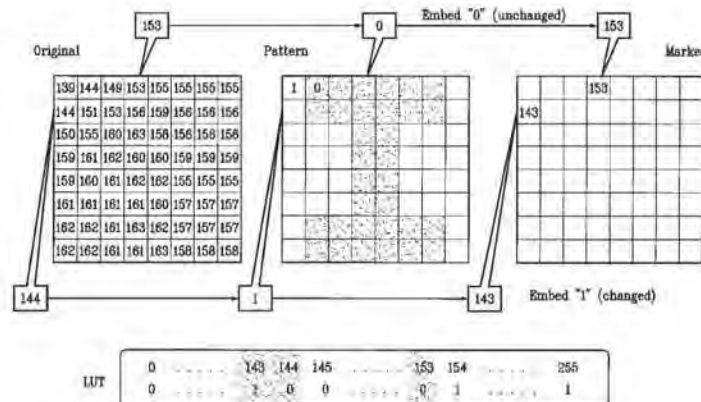
Primary Examiner—Andrew W. Johns

Assistant Examiner—Shervin Nakhjavan

(74) Attorney, Agent, or Firm—Woodcock Washburn Kurtz Mackiewicz & Norris LLP

(57) **ABSTRACT**

A digital watermarking process whereby an invisible watermark inserted into a host image is utilized to determine whether or not the image has been altered and, if so, where in the image such alteration occurred. The watermarking method includes the steps of providing a look-up table containing a plurality of coefficients and corresponding values; transforming the image into a plurality of blocks, wherein each block contains coefficients matching coefficients in the look-up table; and embedding the watermark in the image by performing the following substeps for at least some of the blocks: First, a coefficient is selected for insertion of a marking value representative of a corresponding portion of the watermark. Next, the value of the selected coefficient is used to identify a corresponding value in the look-up table. Finally, the identified coefficient is left unchanged if the corresponding value is the same as the marking value, and is changed if the corresponding value is different from the marking value. After the insertion of the watermark, the image may be stored in a lossy-compression form, thus permitting efficient storage and distribution. Moreover, the method may be used to produce two output signals for authentication: (1) a meaningful pattern to facilitate a quick visual check, and (2) an additional signal to detect unauthorized alteration. The method can be applied to an image compressed using JPEG or other techniques, such as Wavelet compression, and the marked image can be kept in the compressed format. Any alteration made on the marked image can be localized, making the method suitable for use in a "trustworthy" digital camera or camcorder.

14 Claims, 13 Drawing Sheets-

US006282300B1

(12) **United States Patent**
Bloom et al.

(10) **Patent No.:** **US 6,282,300 B1**
 (45) **Date of Patent:** **Aug. 28, 2001**

(54) **ROTATION, SCALE, AND TRANSLATION
 RESILIENT PUBLIC WATERMARKING FOR
 IMAGES USING A LOG-POLAR FOURIER
 TRANSFORM**

(75) Inventors: **Jeffrey A. Bloom**, Plainsboro; **Ingemar
 J. Cox**, Lawrenceville; **Matthew L.
 Miller**; **Min Wu**, both of Princeton, all
 of NJ (US); **Ching-Yung Lin**, New
 York; **Yui Man Lui**, Middle Island,
 both of NY (US)

(73) Assignee: **Signafy, Inc.**, Princeton, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this
 patent is extended or adjusted under 35
 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/489,752**

(22) Filed: **Jan. 21, 2000**

(51) Int. Cl.⁷ **H04K 1/00**

(52) U.S. Cl. **382/100**

(58) Field of Search 382/100, 232,
 382/280; 380/210, 252, 287, 54; 713/176;
 370/527, 529

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,185,312 * 2/2001 Nakamura et al. 382/100

FOREIGN PATENT DOCUMENTS

0 905 967 A1 * 3/1999 (EP) H04N/1/32
 WO-99/

17536-A1 * 4/1999 (WO) H04N/1/32

OTHER PUBLICATIONS

Ó Ruanaidh et al., "Rotation, Scale and Translation Invariant
 Digital Image Watermarking," Proc. IEEE Int. Conf. on
 Image Processing, Oct. 1997, pp. 536-539.*

Ó Ruanaidh et al., "Rotation, Scale and Translation Invariant
 Spread Spectrum Digital Image Watermarking," Signal Pro-
 cessing, vol. 66, May 1998, pp. 303-317.*

Pereira et al., "Template Based Recovery of Fourier-Based
 Watermarks Using Log-polar and Log-log Maps," Proc.
 IEEE Int. Conf. on Multimedia Computing and Systems,
 Jun. 1999, pp. 870-874.*

Lin et al., "Public Watermarking Surviving General Scaling
 and Cropping: An Application for Print-and-Scan Process,"
 Multimedia and Security Workshop at ACM Multimedia
 '99, Oct. 1999, pp. 41-46.*

* cited by examiner

Primary Examiner—Andrew W. Johns

(74) *Attorney, Agent, or Firm*—Scully, Scott, Murphy &
 Presser

(57) **ABSTRACT**

A method for detecting a watermark signal in digital image
 data. The detecting method includes the steps of: computing
 a log-polar Fourier transform of the image data to obtain a
 log-polar Fourier spectrum; projecting the log-polar Fourier
 spectrum down to a lower dimensional space to obtain an
 extracted signal; comparing the extracted signal to a target
 watermark signal; and declaring the presence or absence of
 the target watermark signal in the image data based on the
 comparison. Also provided is a method for inserting a
 watermark signal in digital image data to obtain a water-
 marked image. The inserting method includes the steps of:
 computing a log-polar Fourier transform of the image data
 to obtain a log-polar Fourier spectrum; projecting the log-
 polar Fourier spectrum down to a lower dimensional space
 to obtain an extracted signal; modifying the extracted signal
 such that it is similar to a target watermark; performing a
 one-to-many mapping of the modified signal back to log-
 polar Fourier transform space to obtain a set of watermarked
 coefficients; and performing an inverse log-polar Fourier
 transform on the set of watermarked coefficients to obtain a
 watermarked image.

14 Claims, 27 Drawing Sheets

US006230268B1

(12) **United States Patent**
Miwa et al.

(10) **Patent No.:** **US 6,230,268 B1**
(45) **Date of Patent:** **May 8, 2001**

(54) **DATA CONTROL SYSTEM**

(75) Inventors: **Kunihiko Miwa**, Hiratsuka; **Norishige Morimoto**, Tokyo-to; **Shuichi Shimizu**, Yokohama, all of (JP)

(73) Assignee: **International Business Machines Corporation**, Armonk, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(h) by 0 days.

(21) Appl. No.: **09/127,061**

(22) Filed: **Jul. 31, 1998**

(30) **Foreign Application Priority Data**

Sep. 12, 1997 (JP) 9-248272

(51) Int. Cl.⁷ **G06F 11/30**

(52) U.S. Cl. **713/176; 713/164; 713/165; 713/182**

(58) Field of Search 713/165, 164, 713/176, 179, 180, 182, 189, 200, 201

(56) **References Cited**

PUBLICATIONS

"IBM DataHiding™ Proposal—Version 1.0," *IBM Corporation*, Issued by the Data Hiding Subgroup, pp. 1–29, Sep. 2, 1997.

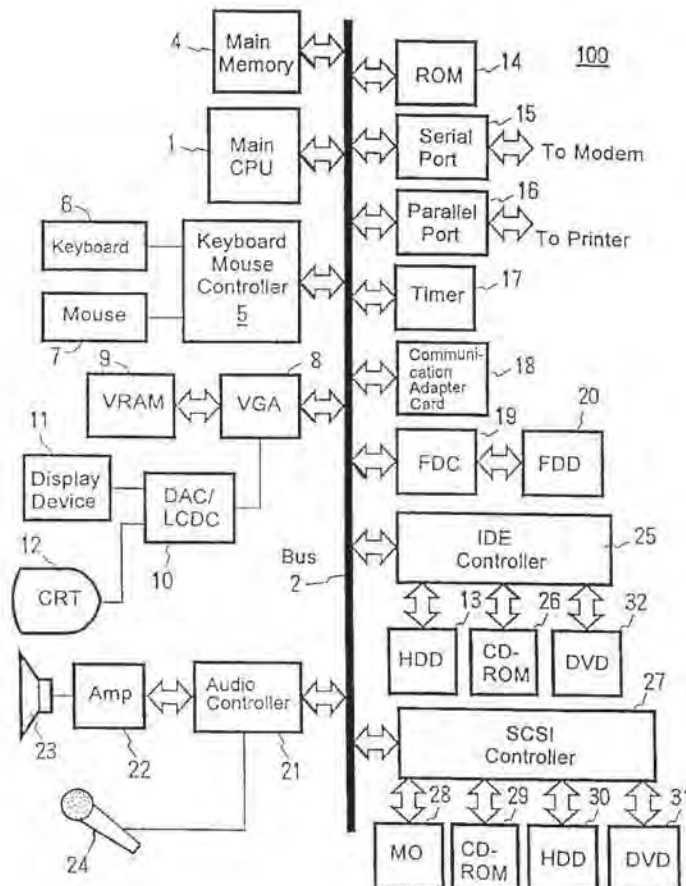
Primary Examiner—Thomas R. Peeso

(74) *Attorney, Agent, or Firm*—Scully, Scott, Murphy & Presser; Louis P. Herzberg

(57) **ABSTRACT**

An object of the invention is to provide a system and method for effecting a secure data control using an electronic watermarking with a low manufacturing cost. A solution of the objective is a data control system is built which comprises; embedding a control flag indicating to control data using an electronic watermarking technique, preparing a token having information as to how to control the data by using the content of the data, distributing the token appended to the data, detecting the control flag from the distributed data, reading the token appended to the data when the control flag is detected, and controlling the data according to a pre-defined control rule of the token or the control flag. In addition, a subsequent data control is further suppressed by modifying the token in controlling the data.

42 Claims, 7 Drawing Sheets



US006208745B1

(12) **United States Patent**
Florencio et al.

(10) **Patent No.:** **US 6,208,745 B1**
 (45) **Date of Patent:** ***Mar. 27, 2001**

(54) **METHOD AND APPARATUS FOR
 IMBEDDING A WATERMARK INTO A
 BITSTREAM REPRESENTATION OF A
 DIGITAL IMAGE SEQUENCE**

(75) **Inventors:** **Dinei A. Florencio; Michael A.
 Isnardi, both of Plainsboro, NJ (US)**

(73) **Assignee:** **Sarnoff Corporation, Princeton, NJ
 (US)**

(*) **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **09/001,205**

(22) **Filed:** **Dec. 30, 1997**

(51) **Int. Cl.⁷** **G06K 9/00; G06K 9/36;
 H04L 9/00**

(52) **U.S. Cl.** **382/100; 382/250; 713/176**

(58) **Field of Search** **382/232, 250,
 382/251, 100; 162/110; 380/4, 51; 713/176**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,530,759	6/1996	Braudaway et al.	380/54
5,568,570	10/1996	Rabbani	382/238
5,636,292	6/1997	Rhoads	382/232
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sandford, II et al.	707/101
5,661,574	8/1997	Kawana	358/501
5,664,018	9/1997	Leighton	380/54
5,778,102 *	7/1998	Sandford, II et al.	382/251

5,825,892 *	10/1998	Braudaway et al.	380/51
5,848,155 *	12/1998	Cox	380/4
5,862,260 *	1/1999	Rhoads	382/232
5,915,027 *	6/1999	Cox et al.	380/54
5,933,798 *	8/1999	Linnartz	702/191

FOREIGN PATENT DOCUMENTS

0 805 600 A2	11/1997	(EP)
0 840 513 A2	5/1998	(EP)

OTHER PUBLICATIONS

Adaptive Watermarking in the DCT Domain, Tao et al; IEEE Conference on Acoustics, Speech, and Signal Processing, ISBN: 0-8186-7919-0, vol. 4, pp. 2985-2988, 1997.*

I. Cox, J. Kilian, T. Leighton, T. Shamoan "Secure Spread Spectrum Watermarking for Multimedia", NEC Research Institute, Technical Report 95-10.

F. Hartung, B. Girod, "Watermarking of MPEG-2 encoded video without decoding and re-encoding", Proceedings SPIE 3020: Multimedia Computing and Networking 97 (MMCN 97) Feb. 1997.

F. Hartung, B. Girod, "Digital Watermarking of Raw and Compressed Video", Systems for Video Communication, pp. 205-213, Oct. 1996.

(List continued on next page.)

Primary Examiner—Amelia Au

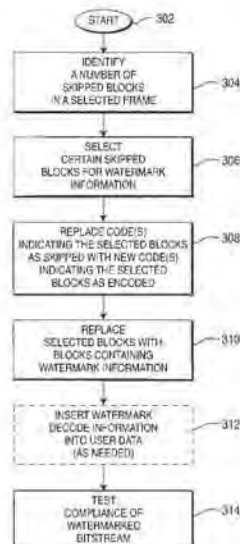
Assistant Examiner—Mehrdad Dastouri

(74) *Attorney, Agent, or Firm*—William J. Burke

(57) **ABSTRACT**

A method and apparatus that inserts watermark information directly into an encoded video bitstream. The method identifies specific blocks or macroblocks in an encoded video bitstream and inserts the watermark information directly into the bitstream such that these selected blocks are replaced with a block containing watermark information or augmented with watermark information.

18 Claims, 2 Drawing Sheets



US006154571A

United States Patent [19]
Cox et al.

[11] **Patent Number:** **6,154,571**
 [45] **Date of Patent:** **Nov. 28, 2000**

[54] **ROBUST DIGITAL WATERMARKING**

[75] **Inventors:** Ingemar J. Cox, Lawrenceville;
 Matthew L. Miller, Princeton, both of
 N.J.; Ryoma Oami, Tokyo, Japan

[73] **Assignees:** NEC Research Institute, Inc.,
 Princeton, N.J.; NEC Corporation,
 Tokyo, Japan

[21] Appl. No.: 09/118,467

[22] Filed: Jul. 17, 1998

Related U.S. Application Data

[60] Provisional application No. 60/090,532, Jun. 24, 1998.

[51] **Int. Cl.**⁷ G06K 9/00

[52] **U.S. Cl.** 382/250; 382/232; 382/100

[58] **Field of Search** 382/100, 232,
 382/250, 276, 251, 252, 244

[56] **References Cited****U.S. PATENT DOCUMENTS**

4,939,515	7/1990	Adelson	341/51
5,319,735	6/1994	Preuss et al.	395/2.14
5,530,751	6/1996	Morris	380/4
5,530,759	6/1996	Braudaway et al.	380/54
5,568,570	10/1996	Rabbani	382/238
5,613,004	3/1997	Cooperman et al.	380/28
5,636,292	6/1997	Rhoads	382/232
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sandford, II et al.	395/612
5,664,018	9/1997	Leighton	380/54
5,687,236	11/1997	Moskowitz et al.	380/28
5,809,139	9/1998	Girod et al.	380/202
6,037,984	3/2000	Isnardi et al.	348/403

FOREIGN PATENT DOCUMENTS

0690595	1/1995	European Pat. Off.	H04L 9/18
2196167	4/1988	United Kingdom	G11B 20/08
8908915	9/1989	WIPO	G11B 21/10
9520291	7/1995	WIPO	H04N 1/32
9621290	7/1996	WIPO	H04H 1/00
9625005	8/1996	WIPO	H04N 7/08
9627259	9/1996	WIPO	H04N 1/32

OTHER PUBLICATIONS

R.G. Van Schyndel et al, "A digital watermark," in Intl. Conf. On Image Processing, vol. 2, pp. 86-90, 1994.

G. Caronni, "Assuring Ownership Rights for Digital Images," in Proc. Reliable IT Systems, VIS '95, 1995.

J. Brassil et al, "Electronic Marking and Identification Techniques to Discourage Document Copying," in Proc. Infocom '94, pp. 1278-1287, 1994.

(List continued on next page.)

Primary Examiner—Bijan Tadayon

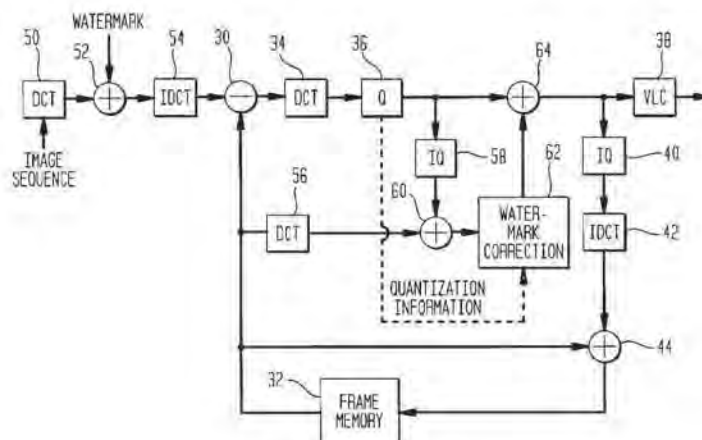
Assistant Examiner—Shervin Nakhjavan

Attorney, Agent, or Firm—Philip J. Feig

[57] **ABSTRACT**

A watermarking procedure that is applicable to images, audio, video and multimedia data to be watermarked divides the data to be watermarked into a set of $n \times n$ blocks, such as the 8×8 blocks of MPEG. The same watermark signal can be distributed throughout the set of blocks in a large variety of ways. This allows the insertion algorithm to be changed without affecting the decoders. The decoding procedure first sums together the DCT coefficients of N sets of 8×8 blocks to form a set of N summed 8×8 blocks and then extracts the watermark from the summed block. Since the sum of the DCT blocks is equal to the DCT of the sum of the intensity blocks, efficient decoding can occur in both the spatial and frequency domains. The symmetric nature of the decoding process allows geometric distortions to be handled in the spatial domain and other signal distortions to be handled in the frequency domain. Moreover, insertion of a watermark signal into image data and the subsequent extraction of the watermark from watermarked image data which has been subject to distortion between the times of insertion and extraction involves the insertion of multiple watermarks designed to survive predefined distortions of the image data, such as panscan or letterbox mode transformations. Alternatively, a registration pattern in the image data, after the image data containing the registration pattern is subject to an unknown distortion, is used to compensate for distortion of the watermarked image data.

10 Claims, 10 Drawing Sheets



US006141754A

United States Patent [19]**Choy**[11] **Patent Number:** **6,141,754**[45] **Date of Patent:** **Oct. 31, 2000**[54] **INTEGRATED METHOD AND SYSTEM FOR CONTROLLING INFORMATION ACCESS AND DISTRIBUTION**[75] Inventor: **David M. Choy**, Los Altos, Calif.[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.[21] Appl. No.: **08/979,713**[22] Filed: **Nov. 28, 1997**[51] Int. Cl.⁷ **G06F 17/30; G06F 12/14**[52] U.S. Cl. **713/200; 705/52; 705/59**[58] Field of Search **713/200, 201, 713/202, 189, 194; 709/229, 226; 711/163; 705/51, 52, 55, 57, 59**[56] **References Cited****U.S. PATENT DOCUMENTS**

5,295,266	3/1994	Hinsley et al.	709/101
5,629,980	5/1997	Stefik et al.	380/4
5,634,012	5/1997	Stefik et al.	705/39
5,638,443	6/1997	Stefik et al.	705/54
5,649,185	7/1997	Antognini et al. .	
5,715,403	2/1998	Stefik et al.	705/44
5,742,759	4/1998	Nessett et al.	713/201
5,758,068	5/1998	Brandt et al.	713/200
5,758,069	5/1998	Olsen	713/201
5,765,152	6/1998	Erickson	707/1
5,826,011	10/1998	Chou et al.	713/200
5,893,910	4/1999	Martineau et al.	707/10
5,922,073	7/1999	Shimada	713/200
5,922,074	7/1999	Richard et al.	713/200
5,941,947	8/1999	Brown et al.	709/225
6,009,525	12/1999	Horstmann	713/200

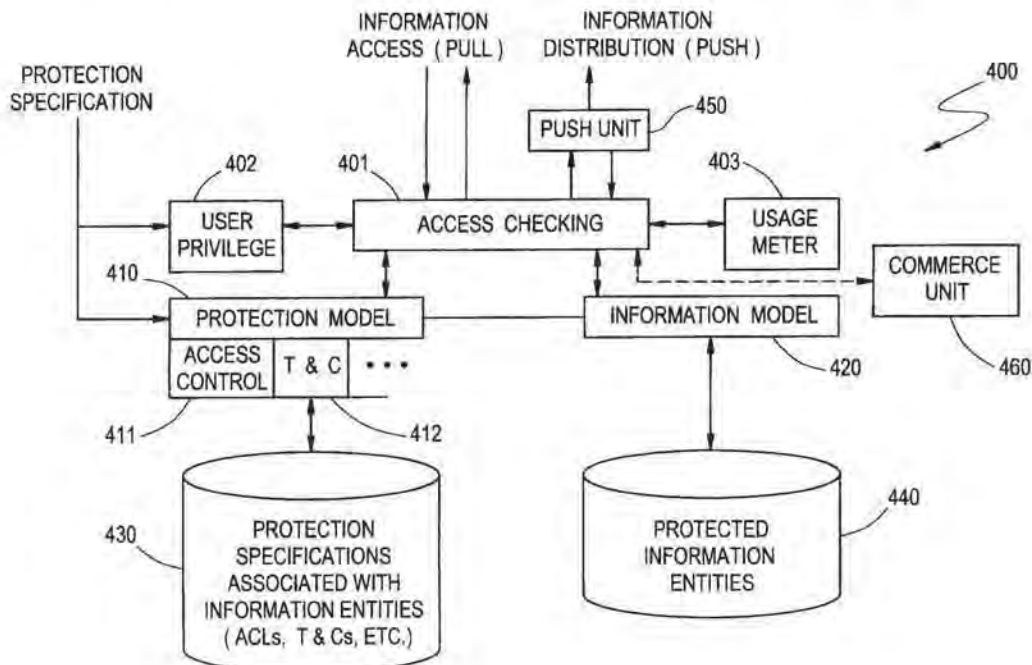
6,044,469 3/2000 Horstmann 713/200

FOREIGN PATENT DOCUMENTS

40-8263440 10/1996 Japan G06F 15/00

Primary Examiner—Robert W. Beausoliel, Jr.*Assistant Examiner*—Christopher Revak*Attorney, Agent, or Firm*—Sughrue, Mion, Zinn, Macpeak & Seas, PLLC[57] **ABSTRACT**

A distributed content entity includes a protection specification and an information entity, in which the protection specification and the information entity are attached and transported together. The protection specification includes information for controlling the use of the information entity. A framework generates the distributed content entity, in which the framework includes a protection specification unit storing the protection specification and including an access control enforcement manager and an enhanced access control enforcement manager; an information unit for storing the protected information entity; and an access checking unit connected to the protection specification unit and the information unit. The access checking unit checks whether a user has a privilege to access the protected information entity based on the protection specification and the access control manager, and checks whether the requested access meets conditions determined based on the protection specification and enforced by the enhanced access control manager. An example of the enhanced access control manager is a terms and conditions enforcement manager for enforcing the terms and conditions of an agreement relating to permitted uses of the protected information entity.

66 Claims, 4 Drawing Sheets

US006069914A

United States Patent [19]
Cox[11] **Patent Number:** **6,069,914**
[45] **Date of Patent:** **May 30, 2000**[54] **WATERMARKING OF IMAGE DATA USING MPEG/JPEG COEFFICIENTS**[75] **Inventor:** Ingemar J. Cox, Lawrenceville, N.J.[73] **Assignee:** NEC Research Institute, Inc., Princeton, N.J.[21] **Appl. No.:** 08/715,953[22] **Filed:** Sep. 19, 1996[51] **Int. Cl.⁷** H04B 1/69[52] **U.S. Cl.** 375/150; 375/130; 375/243; 380/5[58] **Field of Search** 380/5; 375/130, 375/140, 141, 142, 147, 150, 243, 254[56] **References Cited****U.S. PATENT DOCUMENTS**

4,939,515	7/1990	Adelson	341/51
5,319,735	6/1994	Preuss et al.	704/205
5,530,751	6/1996	Morris	380/4
5,530,759	6/1996	Braudaway et al.	380/54
5,568,570	10/1996	Rabbani	382/238
5,636,292	6/1997	Rhoads	382/232
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sandford, II et al.	707/101
5,809,139	9/1998	Girod et al.	380/5
5,848,155	12/1998	Cox	380/4
5,930,369	7/1999	Cox et al.	380/54

FOREIGN PATENT DOCUMENTS

0690595	1/1995	European Pat. Off.	H04L 9/18
2196167	4/1988	United Kingdom	G11B 20/08
8908915	9/1989	WIPO	G11B 20/10
9520291	7/1995	WIPO	H04N 1/32
9621290	7/1996	WIPO	H04H 1/00
9625005	8/1996	WIPO	H04H 7/08
9627259	9/1996	WIPO	H04N 1/32

OTHER PUBLICATIONS

R.G. Van Schyndel et al., "A digital watermark," in Intl. Conf. On Image Processing, vol. 2, pp. 86-90, 1994.

G. Caronni, "Assuring Ownership Rights for Digital Images," in Proc. Reliable IT Systems, VIS '95, 1995.

J. Brassil et al., "Electronic Marking and Identification Techniques to Discourage Document Copying," in Proc. Infocom '94, pp. 1278-1287, 1994.

K. Tanaka et al., "Embedding Secret Information into a Dithered Multi-level Image," in IEEE Military Comm. Conf., pp. 216-220, 1990.

K. Mitsui et al., "Video-Steganography: How to Secretly Embed a Signature in a Picture," in IMA Intellectual Property Project Proc., vol. 1, pp. 187-206, 1994.

Macq and Quisquater, "Cryptology for Digital TV Broadcasting," in Proc. of the IEEE, vol. 83, No. 6, pp. 944-957, 1995.

W. Bender et al., "Techniques for data hiding," in Proc. of SPIE, vol. 2420, No. 40, Jul. 1995.

Koch, Rindfrey and Zhao, "Copyright Protection for Multimedia Data," in Proc. of the Int'l Conf. on Digital Media and Electronic Publishing (Leeds, UK, Dec. 6-8, 1994).

Koch and Zhao, "Towards Robust and Hidden Image Copyright Labeling," in Proc. of 1995 IEEE Workshop on Non-linear Signal and Image Processing (Neos Marmaras, Halkidiki, Greece, Jun. 20-22, 1995).

Zhao and Koch, "Embedding Robust Labels Into Images For Copyright Protection," in Proc. Int. Congr. on IPR for Specialized Information, Knowledge and New Technologies (Vienna, Austria), Aug. 21-25, 1995.

"Digital Copyright: Who Owns What?" NewMedia, Sep. 1995, pp. 38-43.

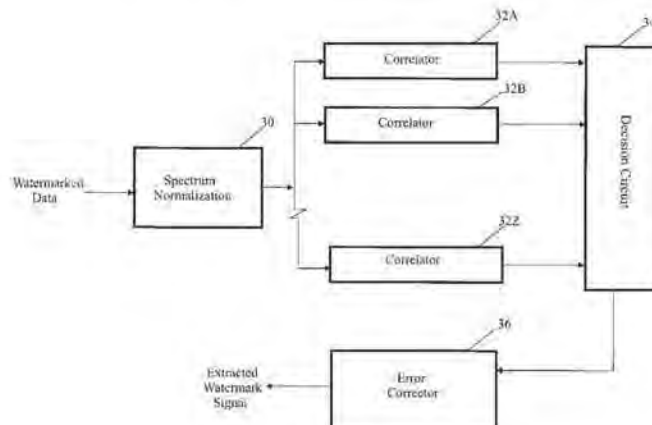
(List continued on next page.)

Primary Examiner—Young T. Tse*Attorney, Agent, or Firm*—Philip J. Feig; Jeffery J. Brosemer

[57]

ABSTRACT

A watermark is embedded into video/image/multimedia data using spread spectrum methodology. The watermark is extracted from watermarked data without the use of an original or unwatermarked version of the data by using MPEG/JPEG coefficients. The image to be watermarked is divided into subimages. Each subimage is embedded with a watermark. When extracting the watermark, the result from each subimage is combined to determine the originally embedded watermark.

18 Claims, 2 Drawing Sheets

US006041316A

United States Patent [19]
Allen

[11] **Patent Number:** **6,041,316**
 [45] **Date of Patent:** **Mar. 21, 2000**

[54] **METHOD AND SYSTEM FOR ENSURING
 ROYALTY PAYMENTS FOR DATA
 DELIVERED OVER A NETWORK**

[75] **Inventor:** **Jonathon Brandon Allen,**
 Mountainside, N.J.

[73] **Assignee:** **Lucent Technologies Inc.,** Murray Hill,
 N.J.

[21] **Appl. No.:** **08/280,039**

[22] **Filed:** **Jul. 25, 1994**

[51] **Int. Cl.⁷** **H04L 9/32**

[52] **U.S. Cl.** **705/52; 705/77**

[58] **Field of Search** 380/4; 705/51-54

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,658,093	4/1987	Hellman	380/4 X
4,740,890	4/1988	William	380/4 X
4,817,140	3/1989	Chandra et al.	
4,827,508	5/1989	Shear	380/4
5,014,234	5/1991	Edwards, Jr.	380/4 X
5,050,213	9/1991	Shear	
5,237,614	8/1993	Weiss	
5,265,164	11/1993	Matyas et al.	
5,321,520	6/1994	Inga et al.	358/403
5,341,429	8/1994	Stringer	380/23
5,457,746	10/1995	Dolphin	380/4

FOREIGN PATENT DOCUMENTS

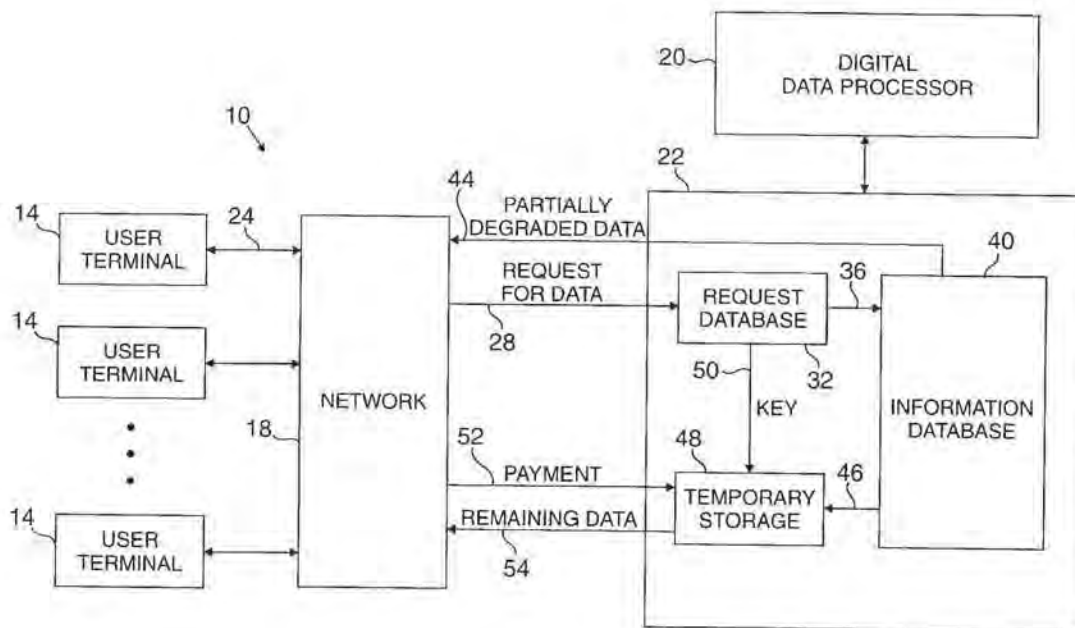
0601500 A7 6/1994 European Pat. Off. G06F 1/00
 0614308 A7 9/1994 European Pat. Off. H04N 1/44

Primary Examiner—Gilberto Barrón, Jr.

[57] **ABSTRACT**

A method and system for delivering data over a communication network which ensures proper payment of royalties while preserving free access to data for purposes such as browsing or research. An exemplary method in accordance with the present invention includes the steps of providing a partially-degraded version of the data over the network, without payment of a royalty fee, to a customer at a user terminal connected to the network; and providing a higher quality version of the data to the customer over the network if the customer is entitled to receive the higher quality version. The determination as to whether the customer is so entitled may be made by, for example, determining if a royalty fee payment has been received. The partially-degraded version of the data is substantially recognizable when displayed, printed, played, run or otherwise utilized by the customer at the user terminal, and may be generated by, for example, deleting or encrypting a portion of the undegraded data. The higher quality version may be provided by transmitting the complete higher quality version, or transmitting remaining data such as the deleted portion or a decryption key, to the user terminal.

27 Claims, 2 Drawing Sheets



US006009176A

United States Patent [19]
Gennaro et al.

[11] **Patent Number:** **6,009,176**
 [45] **Date of Patent:** **Dec. 28, 1999**

[54] **HOW TO SIGN DIGITAL STREAMS**

[75] **Inventors:** **Rosario Gennaro**, New York; **Pankaj Rohatgi**, Yorktown Heights, both of N.Y.

[73] **Assignee:** **International Business Machines Corporation**, Armonk, N.Y.

[21] **Appl. No.:** **08/799,813**

[22] **Filed:** **Feb. 13, 1997**

[51] **Int. Cl.** **H04L 9/00; H04L 9/30**

[52] **U.S. Cl.** **380/25; 380/23; 380/30; 380/49; 370/522**

[58] **Field of Search** **380/9, 23, 25, 380/29, 30, 37, 43, 49, 50, 59; 370/522, 527, 528**

[56] **References Cited****U.S. PATENT DOCUMENTS**

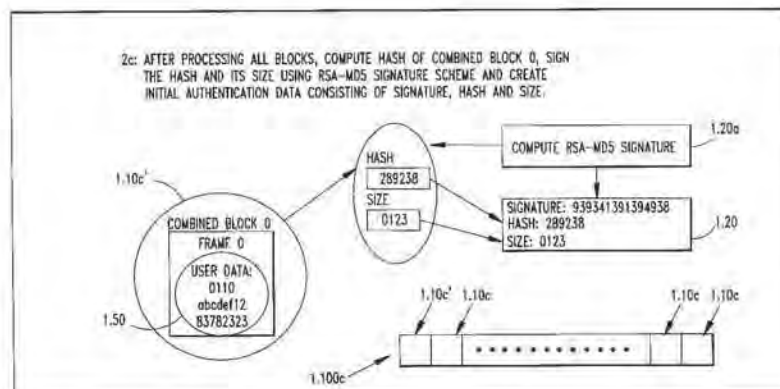
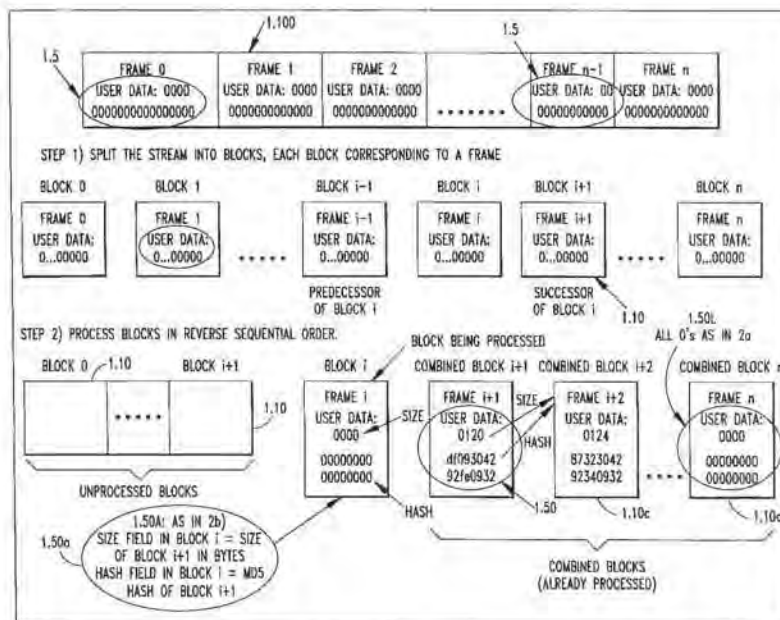
5,646,997 7/1997 Barton 380/23

Primary Examiner—Bernarr E. Gregory
Attorney, Agent, or Firm—Douglas W. Cameron; Anne Vachon Dougherty

[57] **ABSTRACT**

A method of signing digital streams so that a receiver of the stream can authenticate and consume the stream at the same rate which the stream is being sent to the receiver. More specifically, this invention involves computing and verifying a single digital signature on at least a portion of the stream. The properties of this single signature will propagate to the rest of the stream through ancillary information embedded in the rest of the stream.

11 Claims, 13 Drawing Sheets



US005991426A

United States Patent [19]
Cox et al.

[11] **Patent Number:** **5,991,426**
 [45] **Date of Patent:** **Nov. 23, 1999**

[54] **FIELD-BASED WATERMARK INSERTION AND DETECTION**

[75] Inventors: **Ingemar J. Cox**, Lawrenceville;
Matthew L. Miller, Princeton, both of N.J.

[73] Assignee: **Signafy, Inc.**, Princeton, N.J.

[21] Appl. No.: **09/216,499**

[22] Filed: **Dec. 18, 1998**

[51] **Int. Cl.**⁶ **G06K 9/00**

[52] **U.S. Cl.** **382/100; 348/473**

[58] **Field of Search** **382/100, 232; 380/7, 54; 348/473**

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,184,849	2/1993	Taylor	238/67
5,734,752	3/1998	Knox	382/212
5,790,703	8/1998	Wang	382/212

OTHER PUBLICATIONS

Hsu et al., "Digital Watermarking for Video," *IEEE Proc. 13th Int. Conf. on Digital Signal Processing*, Jul. 2-4, 1997, pp. 217-220.

Hsu et al., "DCT-Based Watermarking for Video," *IEEE Transactions on Consumer Electronics*, vol. 44, No. 1, Feb. 1998, pp. 206-216.

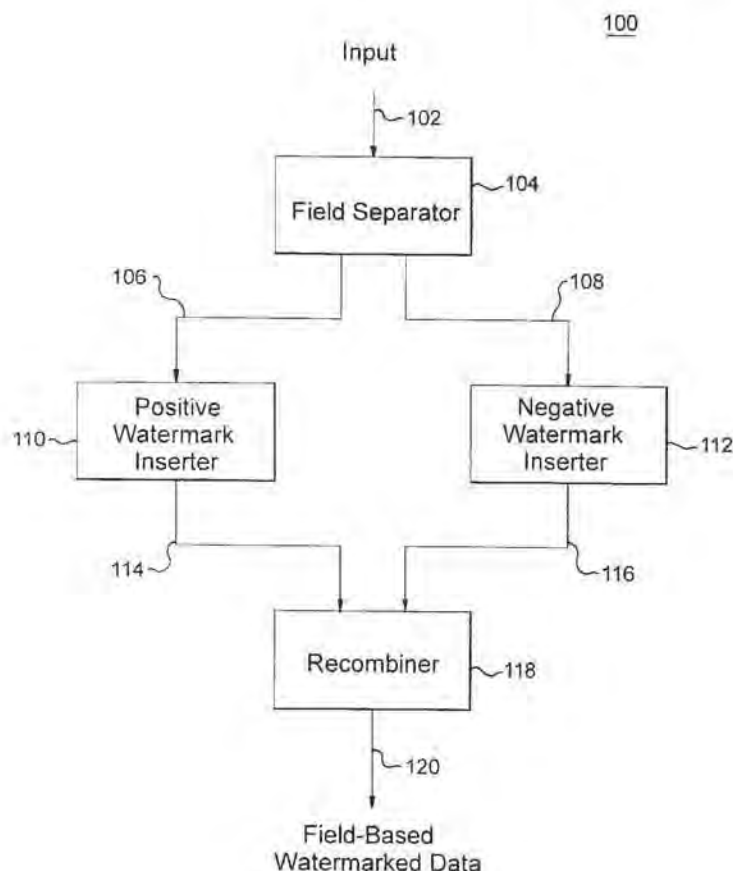
Primary Examiner—Andrew W. Johns

Attorney, Agent, or Firm—Scully, Scott Murphy & Presser

[57] **ABSTRACT**

A digital watermark is inserted into multimedia data containing two image fields by placing a positive watermark into a first field and a negative watermark into a second field. The positive watermark and negative watermark are opposite of one another. The two fields can be interlaced fields of a field-based video signal or alternate rows of a frame-based video signal. The watermark is extracted from field-based watermarked data by separating the watermarked data into two fields and subtracting one of the fields from the other field to generate a watermarked signal. The resultant watermarked signal is processed in a conventional manner to extract and detect the watermark.

22 Claims, 6 Drawing Sheets





US005940134A

United States Patent [19]
Wirtz

[11] **Patent Number:** **5,940,134**
[45] **Date of Patent:** **Aug. 17, 1999**

[54] **MARKING A VIDEO AND/OR AUDIO SIGNAL**

5,517,252 5/1996 Plantholt 348/432
5,627,655 5/1997 Okamoto 386/95
5,668,603 9/1997 Copeland 348/473

[75] Inventor: **Gijsbrecht C. Wirtz**, Eindhoven, Netherlands

FOREIGN PATENT DOCUMENTS

5153637 6/1993 Japan H04N 11/14

[73] Assignee: **U.S. Philips Corporation**, New York, N.Y.

Primary Examiner—David E. Harvey
Attorney, Agent, or Firm—Laurie E. Gathman

[21] Appl. No.: **08/762,624**

[57] **ABSTRACT**

[22] Filed: **Dec. 9, 1996**

[30] **Foreign Application Priority Data**

Dec. 11, 1995 [EP] European Pat. Off. 95203432

[51] **Int. Cl.⁶** **H04N 7/08**

[52] **U.S. Cl.** **348/473; 386/94**

[58] **Field of Search** 348/571, 473,
348/474, 476, 486, 432, 434, 435, 436,
1; 380/5, 3; 455/2; 386/95, 94; H04N 7/08,
7/087

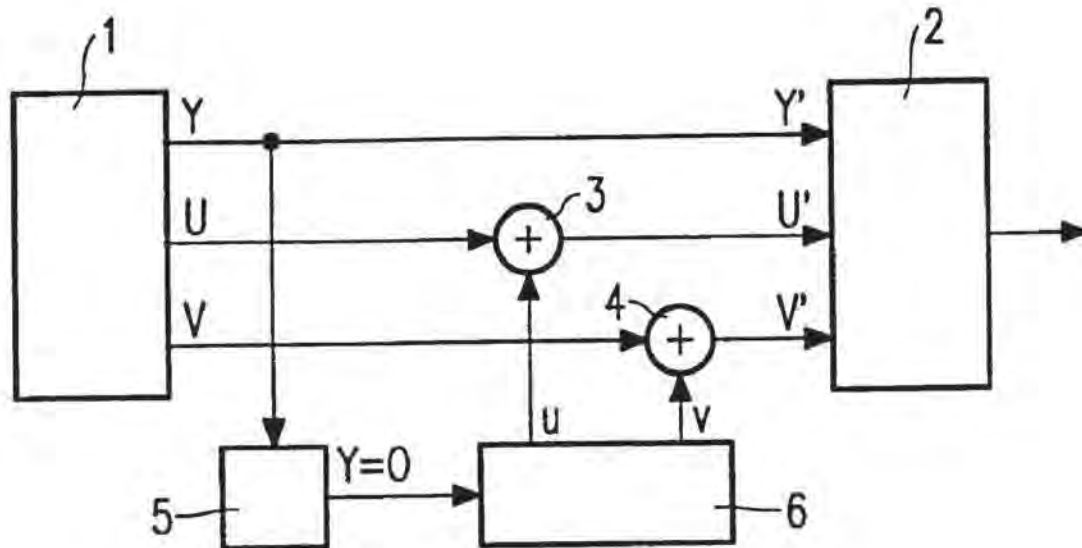
Method and arrangement for marking a video or audio signal to assign a classification to said signal, for example, to identify that the signal is authentic and may not be copied. The signal comprises at least two components (Y, UV) according to a predetermined standard (MPEG, PAL, NTSC). According to the invention, values are assigned to said components which in combination can normally not occur. For example, in black picture portions where Y, U and V are all zero, U and/or V are now wilfully made non-zero to constitute the watermark. Television receivers still display said black portion. The watermark is not lost when the signal is re-encoded and copied on a recordable disc. A player will not reproduce the copy because the watermark no longer corresponds with the "wobble key" of the new disc.

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,218,697 8/1980 Leventer 348/478

15 Claims, 1 Drawing Sheet



US005930369A

United States Patent [19]
Cox et al.

[11] **Patent Number:** **5,930,369**
 [45] **Date of Patent:** **Jul. 27, 1999**

[54] **SECURE SPREAD SPECTRUM
 WATERMARKING FOR MULTIMEDIA DATA**

[75] Inventors: **Ingemar J. Cox**, Lawrenceville; **Joseph J. Kilian**, Princeton Junction; **Talal G. Shamoon**, Princeton, all of N.J.

[73] Assignee: **NEC Research Institute, Inc.**,
 Princeton, N.J.

[21] Appl. No.: **08/926,720**

[22] Filed: **Sep. 10, 1997**

Related U.S. Application Data

[63] Continuation of application No. 08/534,894, Sep. 28, 1995, abandoned.

[51] Int. Cl.⁶ **G09C 5/00; H04L 9/00**

[52] U.S. Cl. **380/54; 380/3; 380/4; 380/23; 380/55; 283/73; 283/113; 283/17**

[58] Field of Search **380/3, 4, 9, 23, 380/54, 59, 51, 55; 283/73, 113, 17, 901**

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,939,515	7/1990	Adelson	341/51
5,319,735	6/1994	Preuss et al.	395/2.14
5,488,664	1/1996	Shamir	380/54
5,530,751	6/1996	Morris	380/4
5,530,759	6/1996	Braudaway	380/54
5,568,570	10/1996	Rabbani	382/238
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sandford, II et al.	395/612
5,664,018	9/1997	Leighton	380/54
5,734,752	3/1998	Knox	380/54 X

FOREIGN PATENT DOCUMENTS

0690595	1/1995	European Pat. Off. .	
2196167	4/1998	United Kingdom .	
8908915	9/1989	WIPO	G11B 20/10
9514289	5/1995	WIPO	G06K 19/14
9520291	7/1995	WIPO .	
9621290	7/1996	WIPO	H04H 1/00
9625005	8/1996	WIPO	H04H 7/08
9627259	9/1996	WIPO .	

OTHER PUBLICATIONS

I. Cox et al, "Secure Spread Spectrum Watermarking for Images, Audio and Video", in IEEE Int. Conference On Image Processing, vol. 3, pp. 243-246, 1996.

I. Cox et al, "A Secure, Robust Watermark for Multimedia", in Information Hiding: First Int. Workshop Proc., R. Anderson, ed., vol. 1174 of Lecture notes in Computer Science, pp. 185-206, Springer-Verlag 1996 IEEE Int. Conf. On Image Processing, 1996.

J. Brassil et al, "Watermarking document images with bounding box expansion", in Information Hiding, R. Anderson, ed., vol. 1174, of Lecture Notes in Computer Science, pp. 227-235, Springer-Verlag, 1996.

J.R. Smith et al, "Modulation and information hiding in images", in information Hiding: First Int. Workshop Proc., R. Anderson, ed., vol. 1174 of Lecture Notes in Computer science, pp. 207-226, Springer-Verlag 1996.

R.L. Rivest et al, "A method for obtaining digital signatures and public-key cryptosystems", Communications Of the ACM, vol. 21, No. 2, Feb. 1978, pp. 120-126.

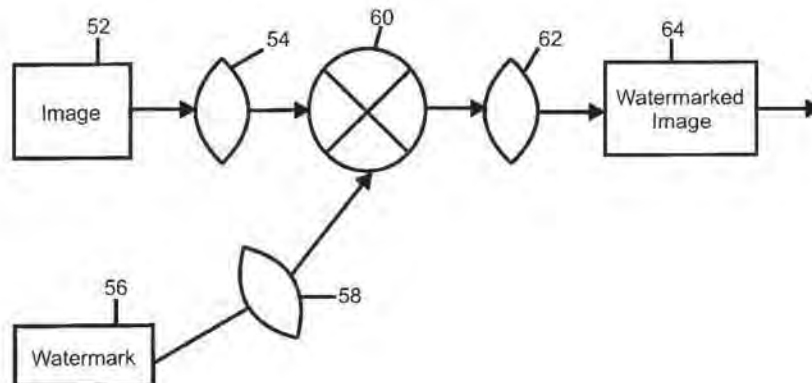
(List continued on next page.)

Primary Examiner—Bernarr E. Gregory
Attorney, Agent, or Firm—Philip J. Feig

[57] **ABSTRACT**

Digital watermarking of audio, image, video or multimedia data is achieved by inserting the watermark into the perceptually significant components of a decomposition of the data in a manner so as to be visually imperceptible. In a preferred method, a frequency spectral image of the data, preferably a Fourier transform of the data, is obtained. A watermark is inserted into perceptually significant components of the frequency spectral image. The resultant watermarked spectral image is subjected to an inverse transform to produce watermarked data. The watermark is extracted from watermarked data by first comparing the watermarked data with the original data to obtain an extracted watermark. Then, the original watermark, original data and the extracted watermark are compared to generate a watermark which is analyzed for authenticity of the watermark.

46 Claims, 6 Drawing Sheets



US005915027A

United States Patent [19]
Cox et al.

[11] **Patent Number:** **5,915,027**
 [45] **Date of Patent:** **Jun. 22, 1999**

[54] **DIGITAL WATERMARKING**

[75] **Inventors:** **Ingemar J. Cox**, Lawrenceville, N.J.;
Matthew L. Miller, Vilnius, Lithuania;
Kazuyoshi Tanaka; **Yutaka Wakasu**,
 both of Tokyo, Japan

[73] **Assignees:** **NEC Research Institute**, Princeton,
 N.J.; **NEC Corporation**, Tokyo, Japan

[21] Appl. No.: **08/746,022**

[22] Filed: **Nov. 5, 1996**

[51] **Int. Cl.**⁶ **H04L 9/02**

[52] **U.S. Cl.** **380/54**

[58] **Field of Search** 388/28, 51, 54

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,939,515	7/1990	Adelson	341/51
5,319,735	6/1994	Preuss et al.	395/2,14
5,530,751	6/1996	Morris	380/4
5,530,759	6/1996	Braudaway et al.	380/54
5,568,570	10/1996	Rabbani	382/238
5,613,004	3/1997	Cooperman et al.	380/28
5,636,292	6/1997	Rhoads	382/232
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sanford, II	395/612
5,687,236	11/1997	Moskowitz et al.	380/28
5,734,752	3/1998	Knox	380/54

FOREIGN PATENT DOCUMENTS

0690595	1/1995	European Pat. Off.	
2196167	4/1988	United Kingdom	
8908915	9/1989	WIPO	
9520291	7/1995	WIPO	
9621290	7/1996	WIPO	H04H 1/00
9625005	8/1996	WIPO	H04H 7/08
9627259	9/1996	WIPO	

OTHER PUBLICATIONS

R.G. Van Schyndel et al., "A digital watermark," in Intl. Conf. On Image Processing, vol. 2, pp. 86-90, 1994.

G. Caronni, "Assuring Ownership Rights for Digital Images," in Proc. Reliable IT Systems, VIS '95, 1995.

J. Brassil et al., "Electronic Marking and Identification Techniques to Discourage Document Copying," in Proc. Infocom '94, pp. 1278-1287, 1994.

K. Tanaka et al., "Embedding Secret Information into a Dithered Multi-level Image," in IEEE Military Comm. Conf., pp. 216-220, 1990.

K. Mitsui et al., "Video-Steganography: How to Secretly Embed a Signature in a Picture," in IMA Intellectual Property Project Proc., vol. 1, pp. 187-206, 1994.

Macq and Quisquater, "Cryptology for Digital TV Broadcasting," in Proc. of the IEEE, vol. 83, No. 6, pp. 944-957, 1995.

W. Bender et al., "Techniques for data hiding," in Proc. of SPIE, vol. 2420, No. 40, Jul. 1995.

Koch, Rindfrey and Zhao, "Copyright Protection for Multimedia Data," in Proc. of the Int'l Conf. on Digital Media and Electronic Publishing (Leeds, UK, Dec., 6-8 1994).

Koch and Zhao, "Towards Robust and Hidden Image Copyright Labeling," in Proc. of 1995 IEEE Workshop on Non-linear Signal and Image Processing (Neos Marmaras, Halkidiki, Greece, Jun. 20-22, 1995).

Zhao and Koch, "Embedding Robust Labels Into Images For Copyright Protection," in Proc. Int. Congr. on IPR for Specialized Information, Knowledge and New Technologies (Vienna, Austria), Aug. 21-25, 1995.

"Digital Copyright: Who Owns What?" NewMedia, Sep. 1995, pp. 38-43.

"Publish and Be Robbed?" New Scientist, Feb. 18, 1995, pp. 32-37.

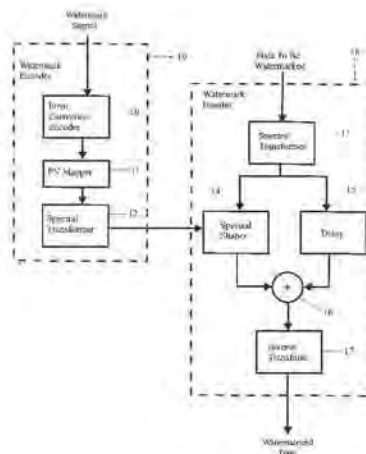
(List continued on next page.)

Primary Examiner—Salvatore Cangialosi
Attorney, Agent, or Firm—Philip J. Feig

[57] **ABSTRACT**

Digital watermarking of data, including image, video and audio data, is performed by repeatedly inserting the watermark into subregions or subimages of the data. Similarly, the watermark is repeatedly extracted from the subregions of the data.

28 Claims, 8 Drawing Sheets



US005903721A

United States Patent [19]
Sixtus

[11] **Patent Number:** **5,903,721**
 [45] **Date of Patent:** **May 11, 1999**

[54] **METHOD AND SYSTEM FOR SECURE
 ONLINE TRANSACTION PROCESSING**

[75] **Inventor:** **Timothy Sixtus, New York, N.Y.**

[73] **Assignee:** **cha!Technologies Services, Inc., New
 York, N.Y.**

[21] **Appl. No.:** **08/816,410**

[22] **Filed:** **Mar. 13, 1997**

[51] **Int. Cl.⁶** **G06F 13/00**

[52] **U.S. Cl.** **395/187.01; 395/188.01**

[58] **Field of Search** **395/188.01, 187.01,
 395/186; 380/3, 4, 21, 23, 24, 25, 30**

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,416,842	5/1995	Aziz	380/30
5,557,518	9/1996	Rosen	364/408
5,592,375	1/1997	Salmon et al.	395/207
5,649,099	7/1997	Theimer et al.	395/187.01
5,678,041	10/1997	Baker et al.	395/609
5,684,950	11/1997	Dare et al.	395/187.01
5,684,951	11/1997	Goldman et al.	395/188.01
5,754,761	5/1998	Willsey	395/186
5,758,069	5/1998	Olsen	395/187.01

OTHER PUBLICATIONS

Netscape Communications Corporation, "Netscape Live-Payment White Paper", Oct. 02, 1996 (located on Internet) pp. 1-14.

Michele Rosen, "Cash for Cyberspace", Midrange Systems, Apr. 12, 1996, pp. 34-35.

Stephan Somogyi, "Mediascape—How Would You Like to Pay for That?", Digital Media, vol.4, No. 7, pp. 13-17.

Candee Wilde, "Internet Security: A Moving Target", Interactive Age, May 13, 1996.

B. Clifford Newman et al. "Requirements for Network Payment: The NetCheque Perspective", pp. 32-36.

Jim Sabo, "Riding Shotgun on the Electronic Stagecoach", NetGuide, Aug., 1996, pp. 119-124.

Larry Loeb, "The Stage is Set", Internet World, Aug., 1996, pp. 55-59.

Marvin A. Sirbu, "Credits and Debits on the Internet", IEEE Spectrum, Feb., 1997, pp. 23-29.

David Chaum et al., "Minting Electronic Cash", IEEE Spectrum, Feb., 1997, pp. 31-34.

Peter S. Gemmell, "Traceable e-Cash", IEEE Spectrum, Feb., 1997, pp. 35-37.

Robert W. Baldwin et al., "Locking the e-Safe", IEEE Spectrum, Feb., 1997, pp. 40-46.

Primary Examiner—Joseph E. Palys

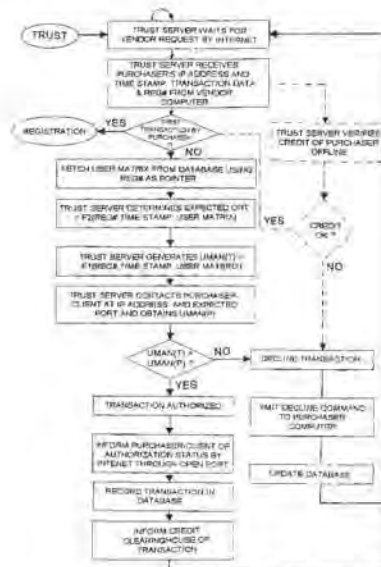
Assistant Examiner—Norman Michael Wright

Attorney, Agent, or Firm—Anthony R. Barkume

[57] **ABSTRACT**

A method for executing a secure online transaction between a vendor computer and a user computer, wherein the vendor computer and the user computer are interconnected to a computer network such as the Internet for data communications therebetween. The method comprises the steps of the user computer transmitting a transaction request message to the vendor computer via the computer network, the financial transaction request comprising user identification data unique to the user computer; in response to receiving the transaction request, the vendor computer sending a transaction verification request to a trust server computer interconnected to the computer network, the transaction verification request comprising the user identification data and data indicative of the requested transaction; in response to receiving the transaction verification request, the trust server computer authenticating the user computer by using the user identification data and communicating with the user computer for verification with the user identification data; and the trust server authorizing the transaction when the authenticating step has passed.

11 Claims, 10 Drawing Sheets



US005848155A

United States Patent [19]

Cox

[11] Patent Number: **5,848,155**
 [45] Date of Patent: **Dec. 8, 1998**

[54] **SPREAD SPECTRUM WATERMARK FOR EMBEDDED SIGNALLING**

[75] Inventor: **Ingemar J. Cox, Lawrenceville, N.J.**

[73] Assignee: **NEC Research Institute, Inc., Princeton, N.J.**

[21] Appl. No.: **708,331**

[22] Filed: **Sep. 4, 1996**

[51] Int. Cl.⁶ **H04L 9/00**

[52] U.S. Cl. **380/4; 380/34**

[58] Field of Search **380/4, 28, 34**

[56] References Cited

U.S. PATENT DOCUMENTS

4,939,515	7/1990	Adelson	341/51
5,319,735	6/1994	Preuss et al.	395/2.14
5,530,751	6/1996	Morris	380/4
5,530,759	6/1996	Braudaway	380/54
5,568,570	10/1996	Rabbani	382/238
5,613,004	3/1997	Cooperman et al.	380/28
5,636,292	6/1997	Rhoads	382/232
5,646,997	7/1997	Barton	380/23
5,659,726	8/1997	Sandford, II et al.	395/612
5,664,018	9/1997	Leighton	380/4

FOREIGN PATENT DOCUMENTS

0690595	1/1995	European Pat. Off.	
2196167	4/1988	United Kingdom	
8908915	9/1989	WIPO	
9520291	7/1995	WIPO	
9621290	7/1996	WIPO	H04H 1/00
9625005	8/1996	WIPO	H04H 7/08
9627259	9/1996	WIPO	

OTHER PUBLICATIONS

R.G. Van Schyndel et al., "A digital watermark," in Intl. Conf. On Image Processing, vol. 2, pp. 86-90, 1994.
 G. Caronni, "Assuring Ownership Rights for Digital Images," in Proc. Reliable IT Systems, VIS '95, 1995.
 J. Brassil et al., "Electronic Marking and Identification Techniques to Discourage Document Copying," in Proc. Infocom '94, pp. 1278-1287, 1994.

K. Tanaka et al., "Embedding Secret Information into a Dithered Multi-level Image," in IEEE Military Comm. Conf., pp. 216-220, 1990.

K. Mitsui et al., "Video-Steganography: How to Secretly Embed a Signature in a Picture," in IMA Intellectual Property Project Proc., vol 1, pp. 187-206, 1994.

Macq and Quisquater, "Cryptology for Digital TV Broadcasting," in Proc. of the IEEE, vol. 83, No. 6, pp. 944-957, 1995.

W. Bender et al., "Techniques for data hiding," in Proc. of SPIE, vol. 2420, No. 40, Jul. 1995.

Koch, Rindfrey and Zhao, "Copyright Protection for Multimedia Data," in Proc. of the Int'l Conf. on Digital Media and Electronic Publishing (Leeds, UK, 6-8 Dec. 1994).

Koch and Zhao, "Towards Robust and Hidden Image Copyright Labeling," in Proc. of 1995 IEEE Workshop on Non-linear Signal and Image Processing (Neos Marmaras, Halkidiki, Greece, Jun. 20-22, 1995).

Zhao and Koch, "Embedding Robust Labels Into Images For Copyright Protection," in Proc. Int. Congr. on IPR for Specialized Information, Knowledge and New Technologies (Vienna, Austria), Aug. 21-25, 1995.

"Digital Copyright: Who Owns What?" NewMedia, Sep. 1995, pp. 38-43.

"Publish and Be Robbed?" New Scientist, 18 Feb. 1995, pp. 32-37.

Kohno et al., "Spread Spectrum Access Methods for Wireless Communications," in IEEE Communications Magazine, Jan. 1995, pp. 58-67, 116.

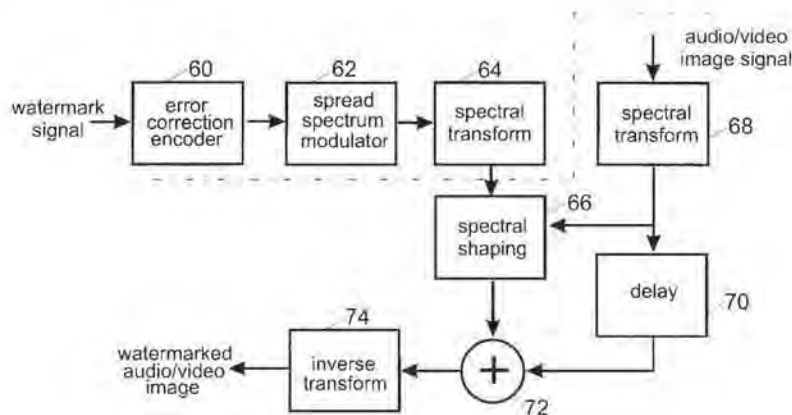
(List continued on next page.)

Primary Examiner—Salvatore Cangialosi
 Attorney, Agent, or Firm—Philip J. Feig

[57] ABSTRACT

A watermark is embedded into audio/video/image/multimedia data using spread spectrum methodology. The watermark is extracted from watermarked data without the use of an original or unwatermarked version of the data by using spatial or temporal local averaging of the frequency coefficients of the watermarked data.

22 Claims, 9 Drawing Sheets





US005799083A

United States Patent [19]

Brothers et al.

[11] **Patent Number:** 5,799,083[45] **Date of Patent:** Aug. 25, 1998[54] **EVENT VERIFICATION SYSTEM**

[76] **Inventors:** Harlan Jay Brothers, 103 Island View
Ter., Branford, Conn. 06405; Chris
Hind Genly, 2137 17th Ave., Forest
Grove, Oreg. 97116

[21] Appl. No.: 702,815

[22] Filed: Aug. 26, 1996

[51] Int. Cl.⁶ H04L 9/00

[52] U.S. Cl. 380/20; 380/23

[58] Field of Search 380/9, 10, 20,
380/23, 49[56] **References Cited**

U.S. PATENT DOCUMENTS

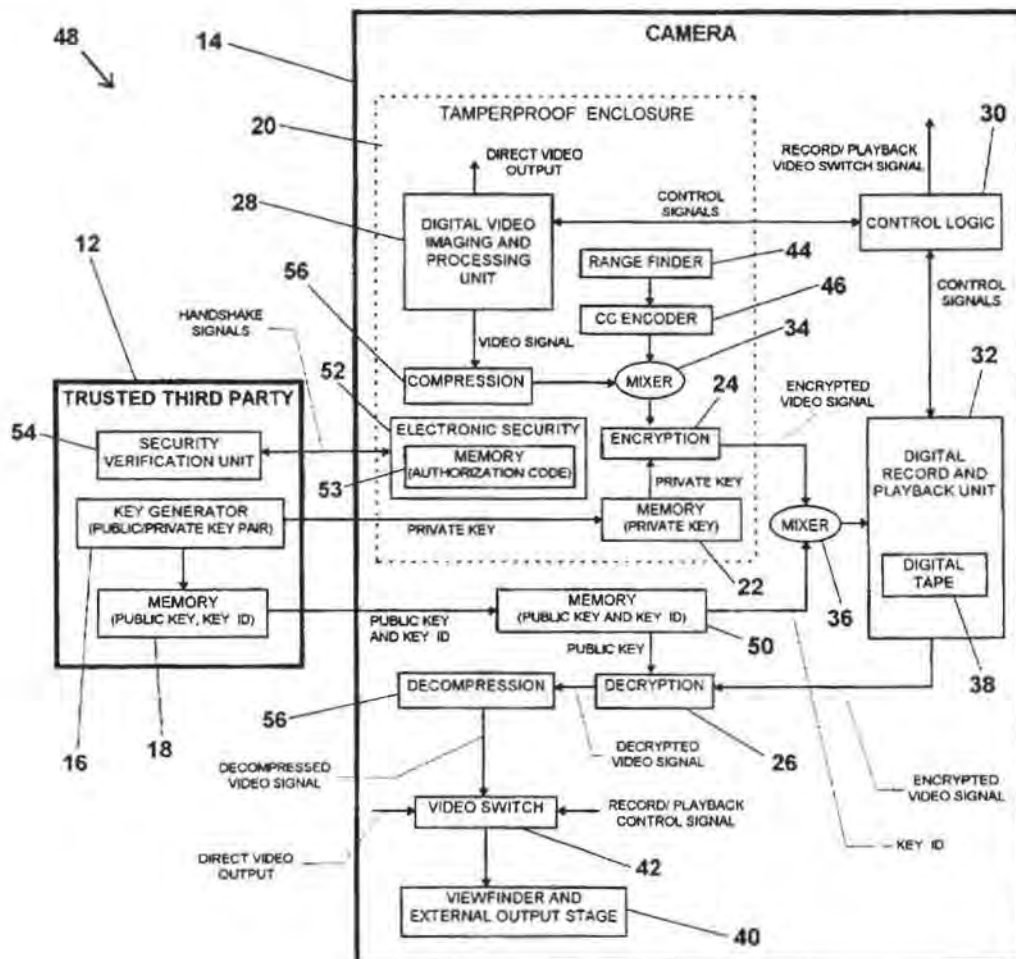
4,882,779 11/1989 Rahtgen 380/24
5,517,567 5/1996 Epstein 380/21

Primary Examiner—David C. Cain

Attorney, Agent, or Firm—Robert L. Tucker, Esq.

[57] **ABSTRACT**

An event verification system comprises an input for the reception of information and an encryption algorithm to encrypt the information; an electronic recorder to record the encrypted information and a decryption algorithm to decrypt recorded information; at least one programmable memory to store at least one cryptographic key for use with the encryption and decryption algorithms; a tamperproof enclosure to protect the input and at least one programmable memory from access or alteration; and, a trusted agent to generate at least one cryptographic key to be used in conjunction with the encryption and decryption algorithms, the trusted agent programming any generated cryptographic key into at least one programmable memory for use with the encryption and decryption algorithms and, upon request, verifying the authenticity of the recorded information by decrypting the recorded information using at least one cryptographic key.

19 Claims, 5 Drawing Sheets



US005737416A

United States Patent [19][11] **Patent Number:** 5,737,416

Cooper et al.

[45] **Date of Patent:** Apr. 7, 1998

[54] **METHOD AND APPARATUS FOR ENABLING TRIAL PERIOD USE OF SOFTWARE PRODUCTS: METHOD AND APPARATUS FOR UTILIZING A DECRYPTION STUB**

[75] Inventors: **Thomas Edward Cooper**, Louisville;
Hudson Wayne Phillips, Boulder;
Robert Franklin Pryor, Longmont, all
of Colo.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: 693,555

[22] Filed: **Aug. 2, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 235,033, Apr. 25, 1994, abandoned.

[51] Int. Cl.⁶ **H04L 9/00**

[52] U.S. Cl. **380/4; 380/9; 380/23; 380/25; 380/49; 380/50; 395/186; 395/427; 395/481; 395/490; 395/491**

[58] Field of Search **380/4, 9, 21, 23, 380/25, 49, 50; 395/601, 616, 186, 427, 481, 490, 491, 726, 728**

[56] **References Cited****U.S. PATENT DOCUMENTS**

4,864,616	9/1989	Pond et al.	380/25
4,888,798	12/1989	Earnest	380/4
5,021,997	6/1991	Archie et al.	395/575
5,155,847	10/1992	Kirouac et al.	395/600
5,166,886	11/1992	Molnar et al.	364/479
5,341,429	8/1994	Stringer et al.	380/23

FOREIGN PATENT DOCUMENTS

0 268 139 A2 5/1988 European Pat. Off. G06F 1/00

0 268 139 A3	5/1988	European Pat. Off.	.....	G06F 1/00
0 561 685 A2	9/1993	European Pat. Off.	.....	G06F 12/14
0 561 685 A3	9/1993	European Pat. Off.	.....	G06F 12/14
0 598 587 A1	5/1994	European Pat. Off.	.....	G06F 1/00
0 601 500 A1	6/1994	European Pat. Off.	.....	G06F 1/00
2 136 175	9/1984	United Kingdom	.....	H03K 13/24
WO 94/07204	3/1994	WIPO	.....	G06F 15/21

OTHER PUBLICATIONS

"Data Masking Algorithm" (IBM Technical Disclosure Bulletin, vol. 32, No. 6B, Nov. 1989).

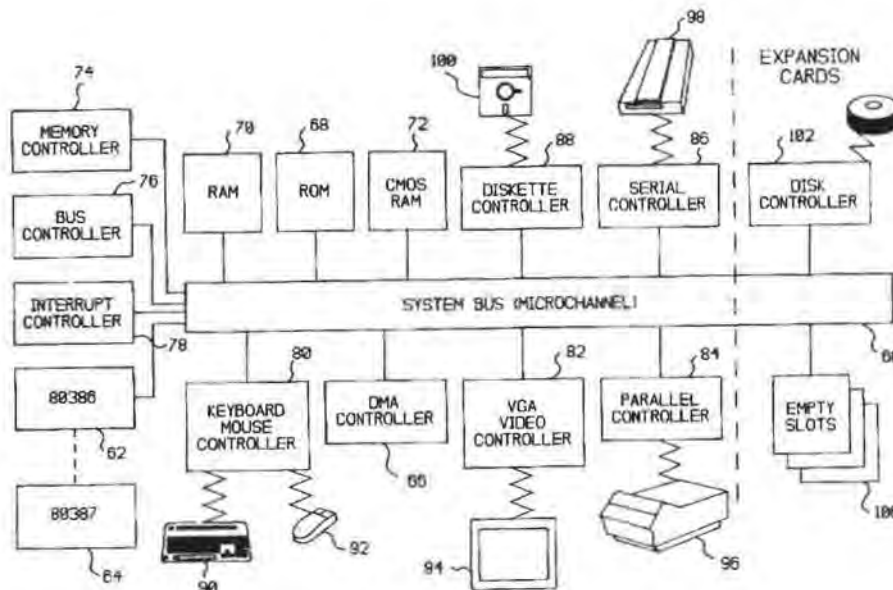
"Information Distribution via Rom Disks" (IBM Technical Disclosure Bulletin, vol. 33 No. 12, May 1991).

Primary Examiner—Bernarr E. Gregory

Attorney, Agent, or Firm—Edward H. Duffield; Andrew J. Dillon

[57] **ABSTRACT**

A method and apparatus is provided in a data processing system for securing access to particular files which are stored in a computer-accessible memory media. A file management program is provided as an operating system component of the data processing system. At least one encrypted file and at least one unencrypted file are stored in the computer-accessible memory media. An unencrypted security stub is associated with each of the encrypted files. The security stub is at least partially composed of executable code. The file management program is utilized to monitor data processing calls for a called file stored in the computer-accessible memory media. The file management program determines what the called file has an associated unencrypted security stub. The called file is processed in a particular manner dependent upon whether or not the called file has an associated unencrypted security stub.

22 Claims, 28 Drawing Sheets



US005734752A

United States Patent [19] Knox

[11] **Patent Number:** 5,734,752
[45] **Date of Patent:** Mar. 31, 1998

[54] **DIGITAL WATERMARKING USING STOCHASTIC SCREEN PATTERNS**

[75] **Inventor:** Keith T. Knox, Rochester, N.Y.

[73] **Assignee:** Xerox Corporation, Stamford, Conn.

[21] **Appl. No.:** 719,235

[22] **Filed:** Sep. 24, 1996

[51] **Int. Cl.⁶** G06K 9/74; H04N 1/405; H04N 1/52

[52] **U.S. Cl.** 382/212; 382/237; 358/536; 358/456; 380/54; 283/113

[58] **Field of Search** 382/219, 212, 382/218, 278, 283, 294; 380/6, 9, 18, 23, 54, 59, 51; 283/901, 113

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,675,948	7/1972	Wicker	283/901
5,315,098	5/1994	Tow	
5,337,361	8/1994	Wang et al.	380/51
5,341,228	8/1994	Parker et al.	
5,396,559	3/1995	McGrew	380/54
5,488,664	1/1996	Shamir	380/54
5,583,950	12/1996	Prokoski	382/212

FOREIGN PATENT DOCUMENTS

651554	5/1995	European Pat. Off.
705025	4/1996	European Pat. Off.

OTHER PUBLICATIONS

Tuhro, "Counterfeit Detection Method", Xerox Disclosure Journal, vol. 20, No. 6, Nov./Dec. 1995.

"Cloaking Device for Top-Secret Faxes", Electronic Imaging Review, Center for Electronic Imaging Systems, University of Rochester, Rochester, NY, Fall, 1995, vol. 2, No. 3, p. 4.

"Digimarc Corp. Announces New Copyright Protection Technology; Irremovable Signatures Protect Creative Property in the Digital Age," Jun. 28, 1995, Business Wire.

"Dice and Digimarc File for Patents for 'Scatter-Gun' Electronic Watermark Technology," Oct. 4, 1995, Computergram International.

"Holographic signatures for digital images; authentication, verification and protection for copyright holders" (Digimarc Corp's copyright protection technology), Aug. 14, 1995, Seybold Report on Desktop Publishing, v. 9, n. 12, p. 23 (2).
"NEC develops digital watermarking technique protecting copyrights of images and music on Internet," Feb. 12, 1996, Business Wire.

"NEC Develops Digital Watermark Technology," Feb. 20, 1996, Newsbytes; NEC Develops Electronic Water Mark in the U.S., Feb. 15, 1996, Computergram International, n. 852.
"NEC Develops Electronic Water Mark in the U.S.", Feb. 15, 1996, Computergram International, n. 852.

Primary Examiner—Scott Rogers

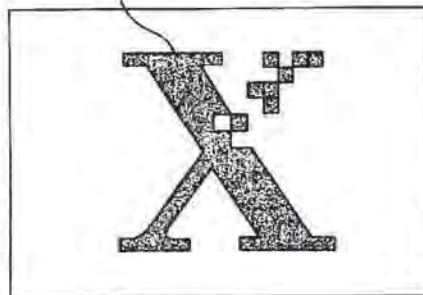
Attorney, Agent, or Firm—Mark Costello

[57] **ABSTRACT**

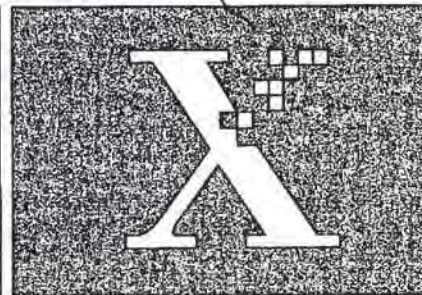
A method for generating watermarks in a digitally reproducible document which are substantially invisible when viewed including the steps of: (1) producing a first stochastic screen pattern suitable for reproducing a gray image on a document; (2) deriving at least one stochastic screen description that is related to said first pattern; (3) producing a document containing the first stochastic screen; (4) producing a second document containing one or more of the stochastic screens in combination, whereby upon placing the first and second document in superposition relationship to allow viewing of both documents together, correlation between the first stochastic pattern on each document occurs everywhere within the documents where the first screen is used, and correlation does not occur where the area where the derived stochastic screens occur and the image placed therein using the derived stochastic screens becomes visible.

16 Claims, 4 Drawing Sheets

Pattern #1



Pattern #2





US005673316A

United States Patent [19]

Auerbach et al.

[11] Patent Number: **5,673,316**
 [45] Date of Patent: **Sep. 30, 1997**

[54] CREATION AND DISTRIBUTION OF CRYPTOGRAPHIC ENVELOPE

[75] Inventors: Joshua Seth Auerbach, Ridgefield, Conn.; Chee-Seng Chow, Cupertino, Calif.; Marc Adam Kaplan, Katonah, N.Y.; Jeffrey Charles Crigler, McLean, Va.

[73] Assignee: International Business Machines Corporation, Armonk, N.Y.

[21] Appl. No.: 625,475

[22] Filed: Mar. 29, 1996

[51] Int. Cl.⁶ H04L 9/00

[52] U.S. Cl. 380/4; 380/25

[58] Field of Search 380/3, 4, 23, 24, 380/25, 28, 49

[56] References Cited

U.S. PATENT DOCUMENTS

5,319,705	6/1994	Halter et al.	380/4
5,394,469	2/1995	Nagel et al.	380/4
5,416,840	5/1995	Cane et al.	380/4
5,428,685	6/1995	Kadooka et al.	380/25
5,490,216	2/1996	Richardson	380/4
5,509,070	4/1996	Schull	380/4
5,530,752	6/1996	Rubin	380/4

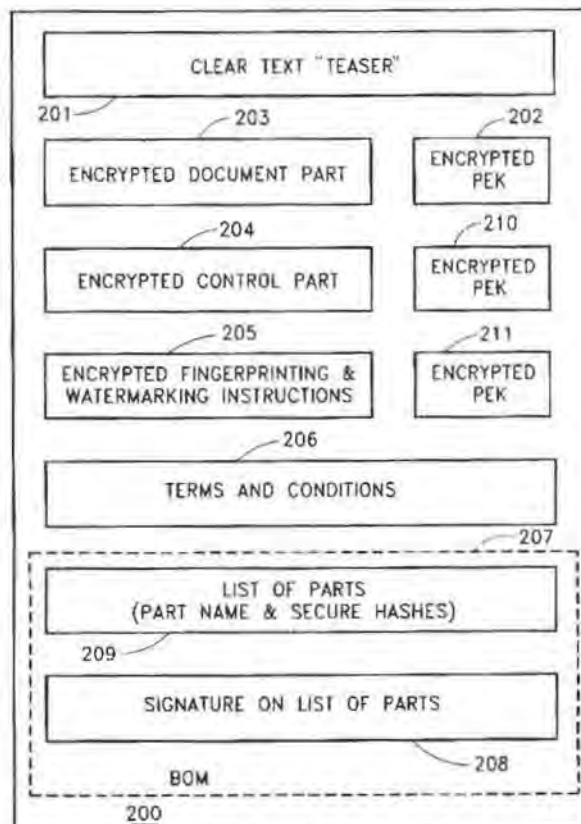
5,553,143 9/1996 Ross et al. 380/25
 5,586,186 12/1996 Yuval et al. 380/4

Primary Examiner—David C. Cain
 Attorney, Agent, or Firm—Douglas W. Cameron

[57] ABSTRACT

A method and apparatus to create, distribute, sell and control access to digital documents using secure cryptographic envelopes. An envelope is an aggregation of information parts, where each of the parts to be protected are encrypted with a corresponding part encryption key. These encrypted information parts along with the other information parts become part of the envelope. Each part encryption key is also encrypted with a public key, and these encrypted part encryption keys are also included in the envelope. The envelope also includes a list of parts where each entry in the list has a part name and a secure hash of the named part. The list is then signed with a secret key to generate a signature, which is also included in the envelope. The signature can be verified using a second public key associated with first secret key, and the integrity of any information part in the envelope can be checked by computing a second hash and comparing it with the corresponding hash in the list of parts. Also, the information content of any encrypted part can only be recovered by knowledge of a second secret key corresponding to the public key that was used to encrypt the part encryption keys.

8 Claims, 6 Drawing Sheets





US005629980A

United States Patent [19]
Stefik et al.

[11] **Patent Number:** **5,629,980**
 [45] **Date of Patent:** **May 13, 1997**

- [54] **SYSTEM FOR CONTROLLING THE DISTRIBUTION AND USE OF DIGITAL WORKS**
 [75] Inventors: **Mark J. Stefik**, Woodside; **Michalene M. Casey**, Morgan Hill, both of Calif.
 [73] Assignee: **Xerox Corporation**, Stamford, Conn.

Weber, R., "Digital Rights Management Technology", Oct. 1995.

European Search Report for Corresponding European Application 95308420.9.

(List continued on next page.)

- [21] Appl. No.: **344,042**
 [22] Filed: **Nov. 23, 1994**
 [51] Int. Cl.⁶ **H04L 9/00**
 [52] U.S. Cl. **380/4**
 [58] Field of Search **380/4; 235/380**

Primary Examiner—Salvatore Cangialosi
Attorney, Agent, or Firm—Richard B. Domingo

[57] **ABSTRACT**

A system for controlling use and distribution of digital works. In the present invention, the owner of a digital work attaches usage rights to that work. Usage rights are granted by the "owner" of a digital work to "buyers" of the digital work. The usage rights define how a digital work may be used and further distributed by the buyer. Each right has associated with it certain optional specifications which outline the conditions and fees upon which the right may be exercised. Digital works are stored in a repository. A repository will process each request to access a digital work by examining the corresponding usage rights. Digital work playback devices, coupled to the repository containing the work, are used to play, display or print the work. Access to digital works for the purposes of transporting between repositories (e.g. copying, borrowing or transfer) is carried out using a digital work transport protocol. Access to digital works for the purposes of replay by a digital work playback device (e.g. printing, displaying or executing) is carried out using a digital work playback protocol.

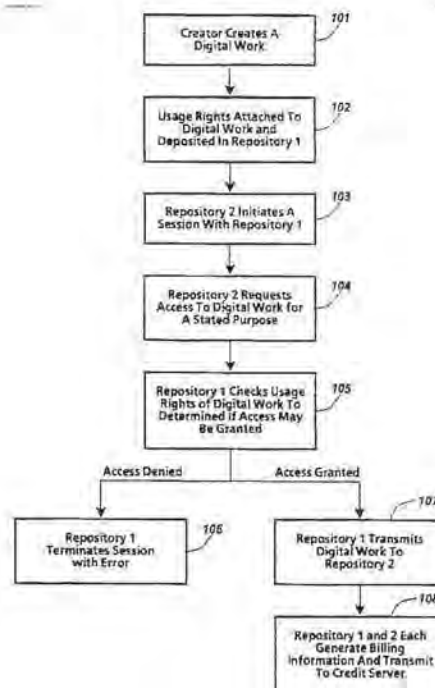
- [56] **References Cited**
U.S. PATENT DOCUMENTS
 3,263,158 7/1966 Janis 380/4
 4,529,870 7/1985 Chaum 235/380
 4,658,093 4/1987 Hellman 380/25
 4,924,378 5/1990 Hershey et al. 364/200

(List continued on next page.)

- FOREIGN PATENT DOCUMENTS**
 0332707 9/1989 European Pat. Off. .
 2236604 4/1991 United Kingdom .
 WO9220022 11/1992 WIPO .
 9301550 1/1993 WIPO G06F 11/34

OTHER PUBLICATIONS
 Press Release From Electronic Publishing Resources, Inc. (EPR) entitled "National Semiconductor and EPR Partner for Information Metering/Data Security Cards", dated Mar. 4, 1994.

31 Claims, 13 Drawing Sheets



US005625690A

United States Patent [19]

Michel et al.

[11] **Patent Number:** 5,625,690[45] **Date of Patent:** Apr. 29, 1997[54] **SOFTWARE PAY PER USE SYSTEM**[75] **Inventors:** Alan D. Michel, Fishers; Robert E. Reinke, Indianapolis, both of Ind.[73] **Assignee:** Lucent Technologies Inc., Murray Hill, N.J.[21] **Appl. No.:** 152,769[22] **Filed:** Nov. 15, 1993[51] **Int. Cl.⁶** H04L 9/00[52] **U.S. Cl.** 380/4; 380/21[58] **Field of Search** 380/4, 21[56] **References Cited****U.S. PATENT DOCUMENTS**

4,433,207	2/1984	Best	380/21
4,658,093	4/1987	Hellman	380/4
4,847,902	7/1989	Hampson	380/4
4,864,494	9/1989	Kobos, Jr.	380/4
4,924,378	5/1990	Hershey et al.	380/4
4,999,806	3/1991	Chernow et al.	380/4
5,103,476	4/1992	Waite et al.	380/4
5,138,712	8/1992	Corbin	380/4
5,173,938	12/1992	Steinbrenner et al.	380/21
5,235,641	8/1993	Nozawa et al.	380/21
5,319,705	6/1994	Halter et al.	380/4
5,349,643	9/1994	Cox et al.	380/4
5,371,692	12/1994	Draeger et al.	380/4
5,392,351	2/1995	Hasebe et al.	380/4

OTHER PUBLICATIONS

Advertisement: Crypkey Software Licensing System, "Hardware key like protection without the hardware key," Dr. Dobbs's Journal, vol. 18, Issue 13, Dec. 1993, p. 143.
 Schneier, Bruce "Untangling Public-Key Cryptography," Dr. Dobbs's Journal, vol. 17, Issue 5, May 1992, pp. 16-18, 20, 22, 24, 26, & 28.

"Special Section: Debating Encryption Standards; The Digital Signature Standard Proposed by NIST; and Responses to NIST's Proposal," Communications of the ACM, vol. 35, No. 7, Jul. 1992, pp. 32-34, 36-54.

Primary Examiner—Salvatore Cangialosi

Attorney, Agent, or Firm—Jeffrey M. Weinick; Donald P. Dinella

[57] **ABSTRACT**

A pay per use system for of the unauthorized use of computer software. An encryption program encodes original software to produce secured software. The encoding is accomplished by using cryptographic techniques. In order to use the software, a user must call a telephone number to receive the cryptographic keys necessary to decrypt the secured software. Thus, users must pay for each use of the secured software. The system allows software developers to freely distribute the secured software. Copies of the secured software may be freely made, because payment is based on each use of the software not on each copy of the software.

25 Claims, 5 Drawing Sheets



US005598470A

United States Patent [19][11] **Patent Number:** **5,598,470****Cooper et al.**[45] **Date of Patent:** **Jan. 28, 1997**

[54] **METHOD AND APPARATUS FOR ENABLING TRIAL PERIOD USE OF SOFTWARE PRODUCTS: METHOD AND APPARATUS FOR UTILIZING A DECRYPTION BLOCK**

0601500A1 6/1994 European Pat. Off. G06F 1/00
2136175 9/1984 United Kingdom H03K 13/24
WO94/07204 3/1994 WIPO G06F 15/21

OTHER PUBLICATIONS

[75] Inventors: **Thomas E. Cooper**, Louisville;
Hudson W. Philips, Boulder; **Robert F. Pryor**, Longmont, all of Colo.

"Data Masking Algorithm" (IBM Technical Disclosure Bulletin, vol. 32 No. 68, Nov. 1989).

"Information Distribution via Rom Disks" (IBM Technical Disclosure Bulletin, vol. 33 No. 12, May 1991).

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

Primary Examiner—Bernarr E. Gregory

Attorney, Agent, or Firm—Edward H. Duffield; Barry J. Bumgardner; Andrew J. Dillon

[21] Appl. No.: **235,031**

[22] Filed: **Apr. 25, 1994**

[51] **Int. Cl.⁶** **H04L 9/32; H04L 9/00**

[52] **U.S. Cl.** **380/4; 380/9; 380/23; 380/25; 380/49; 380/50**

[58] **Field of Search** **380/4, 25, 23, 380/9, 20, 49, 50**

[56] **References Cited****U.S. PATENT DOCUMENTS**

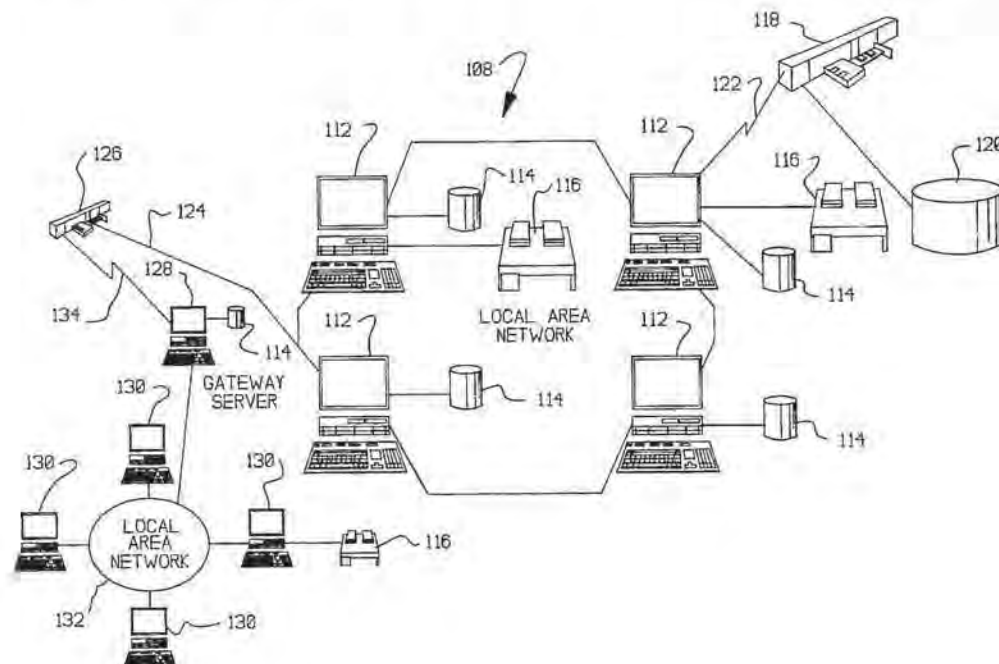
4,864,616	9/1989	Pond et al.	380/25
4,888,798	12/1989	Earnest	380/4
5,021,997	6/1991	Archie et al.	395/575
5,155,847	10/1992	Kirouac et al.	395/600
5,166,886	11/1992	Molnar et al.	364/479
5,341,429	8/1994	Stringer et al.	380/23

FOREIGN PATENT DOCUMENTS

0268139A2	5/1988	European Pat. Off.	G06F 1/00
0268139A3	5/1988	European Pat. Off.	G06F 1/00
0561685A3	9/1993	European Pat. Off.	G06F 12/14
0561685A2	9/1993	European Pat. Off.	G06F 12/14
0598587A1	5/1994	European Pat. Off.	G06F 1/00

[57] **ABSTRACT**

A method and apparatus is provided in a data processing system for securing access to particular files which are stored in a computer-accessible memory media. A file management program is provided as an operating system component of the data processing system. A plurality of files are stored in a computer-accessible memory media, including at least one encrypted file and at least one unencrypted file. For each encrypted file, a preselected portion of the file is recorded in memory, a decryption block is generated which includes information which can be utilized to decrypt the file, and the decryption block is incorporated in the file in lieu of the preselected portion which has been recorded in memory. Then, a file management program is utilized to monitor data processing system calls for files stored in the computer-accessible memory media. The file management program determines whether the called file has an associated decryption block. The called file is processed in a particular manner dependent upon whether or not the called file has an associated decryption block.

8 Claims, 28 Drawing Sheets

US005581703A

United States Patent [19]

Baughner et al.

[11] Patent Number: 5,581,703

[45] Date of Patent: Dec. 3, 1996

- [54] **METHOD AND APPARATUS FOR RESERVING SYSTEM RESOURCES TO ASSURE QUALITY OF SERVICE**
- [75] Inventors: **Mark J. Baughner**, Philip Y. Chang, both of Austin; **Gregory L. Morris**, Round Rock; **Alan P. Stephens**, Austin, all of Tex.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: 84,053

[22] Filed: Jun. 29, 1993

[51] Int. Cl.⁶ G06F 13/14
 [52] U.S. Cl. 395/200.06; 395/200.12
 [58] Field of Search 395/200, 650; 455/17; 370/60, 14, 45, 85.1, 85.7

[56] References Cited

U.S. PATENT DOCUMENTS

4,331,834	5/1982	Ganz et al.	178/3
4,466,058	8/1984	Girard et al.	395/304
4,539,679	9/1985	Bux et al. .	
4,654,867	3/1987	Labeledz et al.	379/59
4,870,641	9/1989	Pattavina .	
4,991,079	2/1991	Dann .	
5,054,109	10/1991	Blackburn	455/17
5,136,581	8/1992	Muehrcke .	
5,187,787	2/1993	Skeen et al. .	
5,231,631	7/1993	Buhrke et al.	370/60
5,265,262	11/1993	Grube et al.	455/17

OTHER PUBLICATIONS

IBM TDB, "Method of Bandwidth Management by Dynamic Port Configuration", vol. 34, No. 7A, Dec. 1991, pp. 261-265.

IBM TDB, "Control Program for Multimedia Workstations", vol. 35, No. 4B, Sep. 1992, pp. 112-113.

IBM TDB, "Automated Accounting Storage Transaction Unit Methodology", vol. 35, No. 6, Nov. 1992, pp. 278-279.

IBM TDB, "Technique for Replicating Distributed Directory Information", vol. 33, No. 12, May 1991, pp. 113-120.

IBM TDB, "Inter-Client Resource Usage in Distributed Client-Server Presentation Manager System", vol. 34, No. 4B, Sep. 1991, pp. 416-417.

IBM TDB, "Method and Apparatus for the Statistical Multiplexing of Voice, Data, and Image Signals," vol. 35, No. 6, Nov. 1992, pp. 409-411.

IBM TDB, "Efficient, Real-Time Address Resolution in Backbone Networks of General Topology", vol. 36, No. 03, Mar. 1993, pp. 133-139.

IEEE Journal on Selected Areas in Communications, vol. 7, No. 5, Jun. 1989, "Packet Communication Protocol for Image Services on a High-Speed Multimedia LAN", M. Mera et al, pp. 782-788.

Advanced Technology Group Apple Computer, Inc., 1991, "Desktop Multimedia Communications—Breaking the Chains", D. Blackketter et al, pp. 73-77.

Lancaster University, UK, "Resource Management in Multimedia Communication Stacks", A. Campbell et al, pp. 287-295, No date.

IEEE Journal on Selected Areas in Communications, vol. 8, No. 3, Apr. 1990, "A Scheme for Real-Time Channel Establishment in Wide-Area Networks", D. Ferrari et al, pp. 368-379.

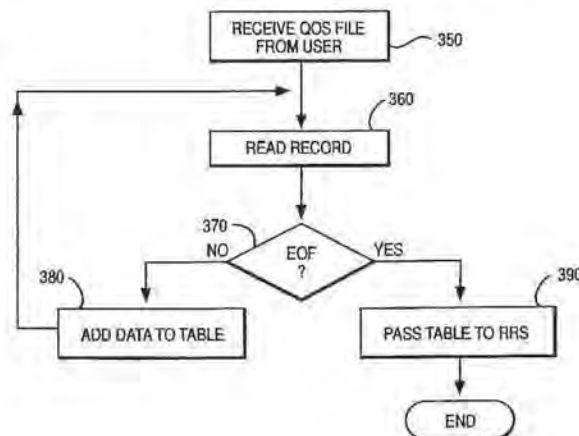
(List continued on next page.)

Primary Examiner—Thomas G. Black
 Assistant Examiner—Peter Y. Wang
 Attorney, Agent, or Firm—Paul S. Drake; Volel Emile

[57] ABSTRACT

A method for providing files to a remote node including the steps of determining whether bandwidth is available for transmitting across a communications link a file requested by a remote node, reserving bandwidth for the requested file if bandwidth is determined to be available, and opening the requested file for transmission only if bandwidth is reserved. In addition, an apparatus for providing files to a remote node including apparatus for determining whether bandwidth is available for transmitting across a communications link a file requested by a remote node, apparatus for reserving bandwidth for the requested file if bandwidth is determined to be available, and apparatus for opening the requested file for transmission only if bandwidth is reserved.

12 Claims, 9 Drawing Sheets





US005548579A

United States Patent [19][11] **Patent Number:** **5,548,579****Lebrun et al.**[45] **Date of Patent:** **Aug. 20, 1996**[54] **SYSTEM FOR EFFECTIVE ALLOCATION OF NETWORK-WIDE BANDWIDTH**5,461,611 10/1995 Drake, Jr. et al. 370/17
5,479,404 12/1995 Francois et al. 370/84[75] Inventors: **Eric Lebrun**, Saint Jeannet; **Pascal Francois**, Vence; **Frederic Raimbault**, Cagnes-Sur-Mer, all of France; **Jeff Warren**, Apex, N.C.*Primary Examiner*—Douglas W. Olms*Assistant Examiner*—Ajit Patel*Attorney, Agent, or Firm*—Gerald R. Woods[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.[57] **ABSTRACT**

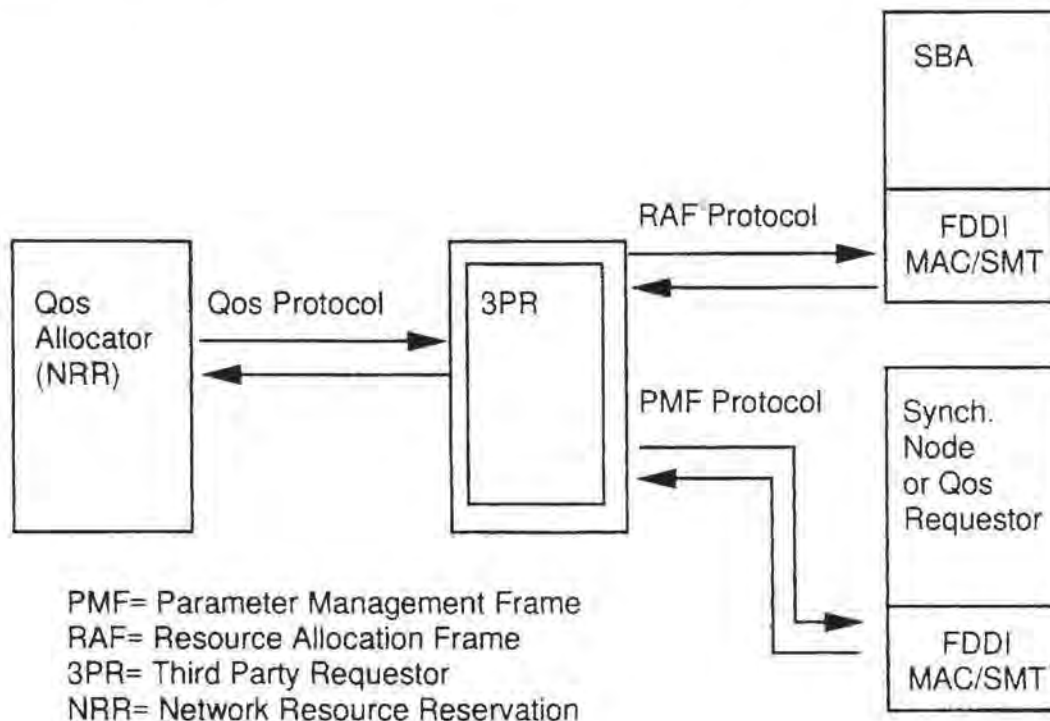
To address Quality of Service (QoS) requirements in a domain of Local Area Networks (LANs) interconnected by at least one FDDI segment, network-wide bandwidth allocation is improved by a high availability Third Party Requestor (3PR) agent. The 3PR receives from the QoS Allocator all information that it needs to ask for bandwidth reservation on the FDDI segment. Following a Station Management standard, the 3PR is able to act on behalf of an FDDI station that will submit synchronous traffic and ask for bandwidth allocation to a Synchronous Bandwidth Allocator (SBA). According to the SBA decision, the 3PR will then answer to the network-centralized QoS Allocator which will grant or deny the allocation over the whole path within the LAN domain. If for some reason, the acting SBA function moves to another station, the 3PR at the new station will become active.

[21] Appl. No.: **493,066**[22] Filed: **Jun. 21, 1995**[30] **Foreign Application Priority Data**

Jun. 23, 1994 [EP] European Pat. Off. 94109763

[51] **Int. Cl.⁶** **H04L 1/22**[52] **U.S. Cl.** **370/16**[58] **Field of Search** 370/85.1, 84, 85.4,
370/85.5, 85.13, 85.14, 85.15, 16, 16.1,
17, 118, 58.3; 340/825.05, 827; 395/181,
182.02, 182.01, 182.08, 182.09[56] **References Cited****U.S. PATENT DOCUMENTS**

5,136,581 8/1992 Myehycke 370/58.1

3 Claims, 9 Drawing Sheets

US005530759A

United States Patent [19]
Braudaway et al.

[11] **Patent Number:** **5,530,759**
 [45] **Date of Patent:** **Jun. 25, 1996**

[54] **COLOR CORRECT DIGITAL WATERMARKING OF IMAGES**

[75] Inventors: **Gordon W. Braudaway**, Yorktown Heights; **Karen A. Magerlein**, Ossining; **Frederick C. Mintzer**, Shrub Oak, all of N.Y.

[73] Assignee: **International Business Machines Corporation**, Armonk, N.Y.

[21] Appl. No.: **381,807**

[22] Filed: **Feb. 1, 1995**

[51] Int. Cl.⁶ **H04K 1/00**

[52] U.S. Cl. **380/54; 580/3; 580/4; 382/137; 355/201**

[58] Field of Search **380/3, 4, 54, 59; 382/7; 355/201**

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,776,013 10/1988 Kafri et al. .
 5,216,724 6/1993 Suzuki et al. 382/7
 5,321,470 6/1994 Hasuo et al. 355/201

5,363,212 11/1994 Taniuchi et al. 358/452
 5,426,710 6/1995 Suzuki et al. 382/135
 5,434,649 7/1995 Hasuo et al. 355/201

OTHER PUBLICATIONS

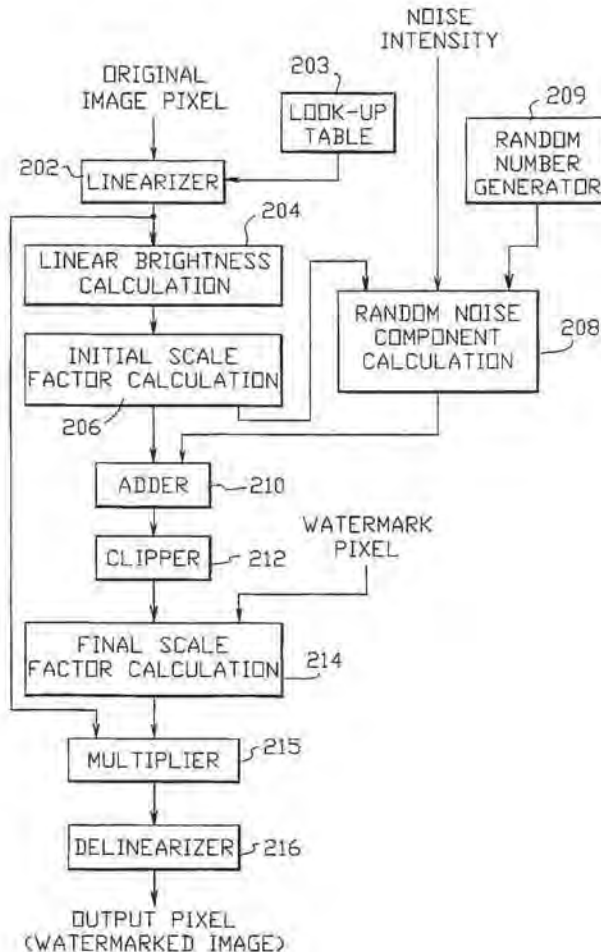
J. Pickerell & A. Child, "Marketing Photography in the Digital Environment", 1994, Image Watermarking for Photoshop.
 K. B. Benson, ed., "Television Engineering Handbook", McGraw-Hill Book Company, New York 1986.

Primary Examiner—David C. Cain
Attorney, Agent, or Firm—Richard M. Ludwin

[57] **ABSTRACT**

A system for placing a visible "watermark" on a digital image is disclosed, wherein an image of the watermark is combined with the digital image. The pixels of the watermark image are examined, and for each pixel whose value is not a specified "transparent" value, the corresponding pixel of the original image is modified by changing its brightness but its chromaticities. This results in a visible mark which allows the contents of the image to be viewed clearly, but which discourages unauthorized use of the image.

12 Claims, 5 Drawing Sheets



US005513261A

United States Patent [19]
Maier

[11] **Patent Number:** **5,513,261**
[45] **Date of Patent:** **Apr. 30, 1996**

[54] **KEY MANAGEMENT SCHEME FOR USE WITH ELECTRONIC CARDS**

4,763,419 4/1988 Roe 380/23 X
4,969,188 11/1990 Schöbi 380/23

[75] Inventor: **David P. Maier**, Windham, N.H.

[73] Assignee: **AT&T Corp.**, Murray Hill, N.J.

Primary Examiner—Gilberto Barrón, Jr.

[21] Appl. No.: **175,027**

[22] Filed: **Dec. 29, 1993**

[51] Int. Cl.⁶ **H04L 9/32; G07F 7/10**

[52] U.S. Cl. **380/23; 380/24; 380/25; 235/380**

[58] Field of Search 380/23-25; 235/380

[56] **References Cited**

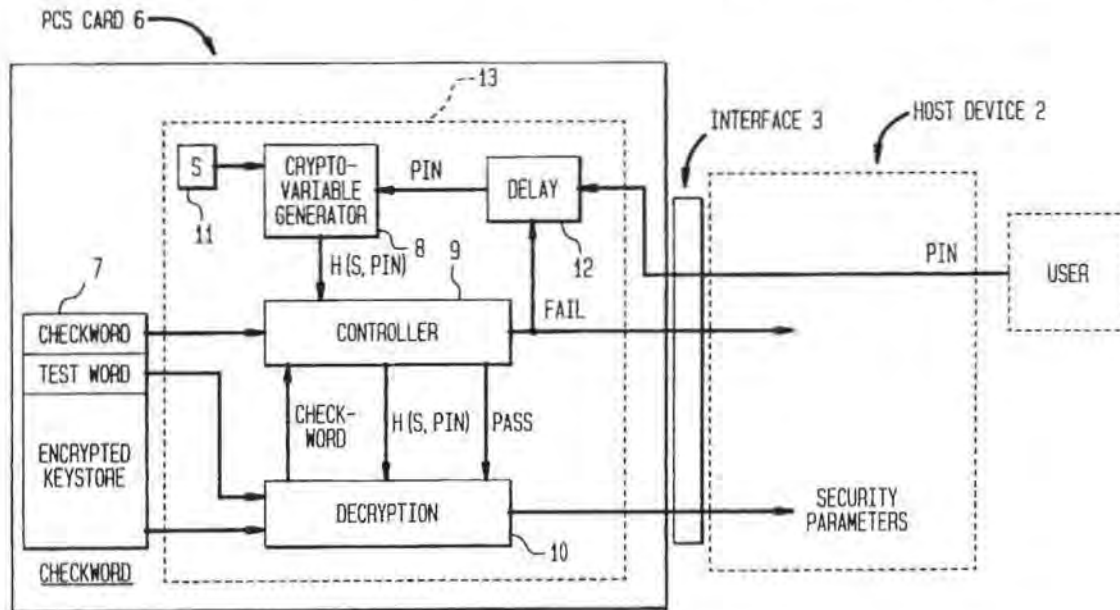
U.S. PATENT DOCUMENTS

4,672,182 6/1987 Hirokawa 235/380

[57] **ABSTRACT**

In an electronic card of the type for insertion into a host electronic device for providing to the host device security parameters pertaining to the rightful holder of the card, the security parameters are stored in encrypted form to preclude their discovery by unauthorized parties. The decryption mechanism resists probing by unauthorized parties.

6 Claims, 2 Drawing Sheets





US005497419A

United States Patent [19] Hill

[11] **Patent Number:** 5,497,419
[45] **Date of Patent:** Mar. 5, 1996

- [54] **METHOD AND APPARATUS FOR RECORDING SENSOR DATA**
[75] Inventor: **Brian R. Hill**, Los Angeles, Calif.
[73] Assignee: **Prima Facie, Inc.**, Conshohocken, Pa.
[21] Appl. No.: **229,602**
[22] Filed: **Apr. 19, 1994**
[51] Int. Cl.⁶ **H04L 9/00**
[52] U.S. Cl. **380/9; 380/25; 380/30; 380/49**
[58] Field of Search **380/9, 23-25, 380/30, 49**

Bruce Schneier, "The Blowfish Encryption Algorithm", *Dr. Dobb's Journal*, Apr. 1994, pp. 38-40.
Bruce Schneier, "RSA Data Security Conference", *Dr. Dobb's Journal*, Apr. 1994, pp. 3-6.
Peter Smith, "LUC Public-key Encryption", *Dr. Dobb's Journal*, Jan. 1993, pp. 44-49.
Tim Victor, "Hands On From Digits to Disc", *CD-ROM Today*, pp. 24-29.
Don Clark, "Norris Plans to Launch Digital Recorder Using Flash Memory Chips From Intel", *The Wall Street Journal*, Mar. 28, 1994.

Primary Examiner—Salvatore Cangialosi
Attorney, Agent, or Firm—Robert M. Storwick

[57] ABSTRACT

A method and apparatus for recording sensor data. The analog and digital signals containing the sensor data are accompanied by a concurrent analog video signal. The analog signals are converted to digital form and highly redundant signals are compressed according to conventional compression techniques. The resulting compressed and uncompressed signals are encrypted and stored on a removable hard disk. The data stored on the removable hard disk can later be played back to reconstruct the original signals while assuring that the played back signals are correct reconstructions of the original signals.

[56] References Cited

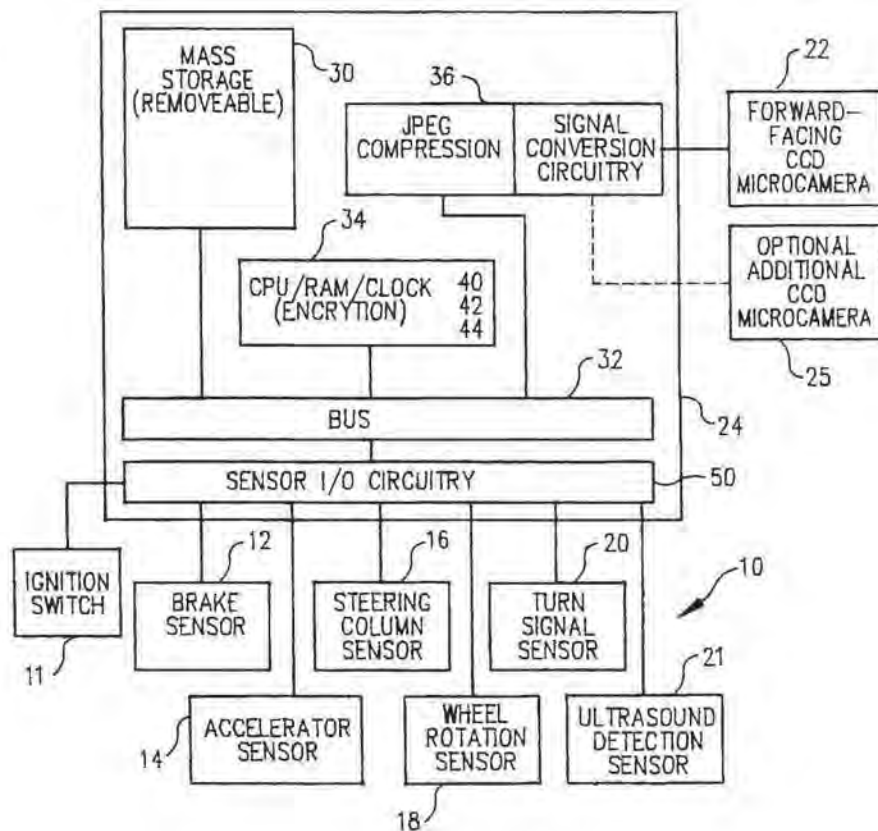
U.S. PATENT DOCUMENTS

4,980,913	12/1990	Skret	380/23
5,321,753	6/1994	Gritton	380/23
5,343,527	8/1994	Moore	380/25
5,361,326	11/1994	Aparicio, IV et al.	395/21

OTHER PUBLICATIONS

Bruce Schneier, "Untangling Public-Key Cryptography", *Dr. Dobb's Journal*, May 1992, pp. 16-28.
Bruce Schneier, "The Cambridge Algorithms Workshop", *Dr. Dobb's Journal*, Apr. 1994, pp. 18-24.

24 Claims, 4 Drawing Sheets



US005379345A

United States Patent [19]

Greenberg

[11] Patent Number: 5,379,345

[45] Date of Patent: Jan. 3, 1995

[54] METHOD AND APPARATUS FOR THE PROCESSING OF ENCODED DATA IN CONJUNCTION WITH AN AUDIO BROADCAST

[75] Inventor: Burton L. Greenberg, New York, N.Y.

[73] Assignee: Radio Audit Systems, Inc., Peekskill, N.Y.

[21] Appl. No.: 11,209

[22] Filed: Jan. 29, 1993

[51] Int. Cl.⁶ H04L 9/00

[52] U.S. Cl. 380/23; 375/1; 380/6; 380/20; 380/31; 380/34; 380/49; 340/825.31; 340/825.34

[58] Field of Search 375/1; 380/34, 6, 20, 380/23, 49, 50, 31, 33; 358/142-147; 340/825.31, 825.34; 348/461-468, 473-486

[56] References Cited

U.S. PATENT DOCUMENTS

2,881,244	4/1959	Pawley et al.	380/20
3,845,391	10/1974	Crosby	380/23 X
4,079,419	3/1978	Siegle et al.	380/20 X
4,313,197	1/1982	Maxemchuk	375/1 X
4,425,661	1/1984	Moses et al.	375/1
4,547,804	10/1985	Greenberg	358/142

4,639,779	1/1987	Greenberg	358/142
4,805,020	2/1989	Greenberg	358/147
4,945,412	7/1990	Kramer	358/142
4,967,273	10/1990	Greenberg	358/142

Primary Examiner—Bernarr E. Gregory
Attorney, Agent, or Firm—Schweitzer Cornman & Gross

[57] ABSTRACT

A method and apparatus for the identification and verification of audio transmission segments, such as may be broadcast by a radio station, consists of the generation of a data stream corresponding in duration to the length of the program segment and including both cumulative time data and segment identification data. The data stream is combined with the program segment to which it relates in a manner in which the data is inaudible on conventional reception apparatus and which does not significantly degrade the audio quality of the program segment. A reception facility is provided to extract the data stream from the recorded audio and compare the data therein with reference data for the transmission, including intended length and time of the segment. By such a comparison verification of the broadcast can be accomplished.

16 Claims, 2 Drawing Sheets

